Regulatory and management options for inspection and maintenance centres

Final Report

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Abbreviations

PUC	Pollution Under Control
CO	Carbon Monoxide
HC	Hydrocarbon
NO_x	Nitrogen Oxides
COP	Conformity of Production
CMV	Central Motor Vehicle
I&M	Inspection & Maintenance
ASM	Accelerated Simulated Mode
IM240	Inspection & Maintenance 240
SS60	Steady Speed 60
VMAS	Vehicle mass analysis system
SIAM	Society for Indian Automobile Manufacturers
SAFE	Society for Automotive fitness and Environment
I&C	Inspection and Certification
JMEA	Japan Machinery Exporters' Association
PQP	Prevailing Quota Premium
LTA	Local Transport Authority
EPA	Environmental Protection Agency
MOT	Motor Testing
VTS	Vehicles Testing Stations
VI	Vehicle Inspector
AE	Authorised Examiner
HMV	Heavy Motor Vehicles
LMV	Light Motor Vehicles
MGV	Medium Goods Vehicles
HGV	Heavy Goods Vehicles
LGV	Light Goods Vehicles
MVI	Motor Vehicle Inspector
RTO	Regional Transport Office

Executive summary

Background

The country witnessed a rapid increase in the vehicular population over the last four decades. From a mere 3 million vehicles in the 1960s, the number went up to over 35 million by the end of century. This growth is expected to continue in the coming years also. Large cities, particularly the metros, are facing a higher concentration of motor vehicles than the smaller towns.

Given this rapid increase in the number of motor vehicles on city roads, increasing attention is on the deteriorating air quality. To mitigate the adverse effects of auto emissions, more stringent emission norms (Euro I, and Euro II) are being introduced for all new vehicles. It is expected that these norms will get progressively more stringent. However, these only help to control the emissions from new vehicles and have no effect on the significant emissions from the vehicles already on the roads, or the "in-use" vehicles.

In case of any emission norms prescribed for the "in-use" vehicles, it is important that there be a mechanism present for certifying that the prescribed norms are met consistently.

Exiting inspection procedure

At present in India, there is no regular fitness-checking programme for the in-use private vehicles. Simple pollution under control (PUC) checks exist from the year 1991 for all on-road vehicles as per Rule 116 of Central Motor Vehicle Rules, 1989. Privately run PUC centres in India do these simple emission tests. Commercial vehicles in addition to PUC checks are required to undergo simple fitness checks. The safety tests include testing of brakes, safety glass, seat belts and anchorage's, signalling and lighting devices tyre tread depth etc.

Major issues and problems

The existing vehicle inspection system in India is inefficient and faces a lot of problems which are discussed below:

- Inspection certification is required only for smaller number of commercial vehicles and is not required for the much larger number of personal vehicles.
- At present, there is only visual inspection carried out by the inspectors, and even that is mandatory only for commercial vehicles. The inspectors and other staff are not given regular training for skill upgradation. There is no set

procedure for inspection and often the decision whether a vehicle is fit or not left to the discretion of the vehicle inspector.

- Personal vehicle owners are required to pay only a "one-time" tax, at the time of initial registration of the vehicle. Therefore presently there is no mechanism by which it is made mandatory for personal vehicles to go in for a regular fitness check.
- The vehicle inspection centres do not have any instrumentation or equipment to carry out proper inspection of the vehicle
- The number of vehicles per inspection centre is very high due to centralised nature of inspection, putting further pressure on the limited capacity of these inspection centres.
- There is no mechanism at present for monitoring performance and capability of these centres.
- Although the present PUC system is authorised, there are no controlling mechanisms like auditing/ inspecting for these PUC Centres. There are no well-defined criteria for authorising / registering a PUC Centre.

India does not have an organised industry for repair and maintenance of vehicles. There are number of roadside mechanics available that may or may not have adequate equipment and training for maintenance,vehicle owners still use their services, as they are cheap and available next door.

Proposed Action Plan

As part of a study undertaken by TERI, an Action Plan has been prepared to strengthen the existing inspection and certification system for improving roadworthiness of in use vehicles in India. An overall framework has been drawn up for effectively implementing an inspection and maintenance program in India. This involves;

- Creating a legislative framework for implementing a comprehensive I&M program
- Strengthening the existing institutional arrangements
- Establishing well equipped and certified vehicle inspection centres
- Introducing stringent emission norms for in use vehicles
- Recommending list of items to be inspected and test procedures for testing vehicles on emission and safety parameters
- Introducing well equipped vehicle repair and maintenance centres

Amendments in Acts

- At present only transport vehicles are required to undergo annual fitness checks. It is therefore imperative that **Section 56 (1) of the Motor Vehicles Act, 1988** should be amended to provide for fitness testing for all categories of vehicles at prescribed periodicity.
- Another important change in the law is **in Section 213 of the Motor Vehicle Act, 1988**. Under this section, a provision may be made authorising the State Governments to constitute a panel of auditors for the purpose of conducting audits of the private inspection centres. Powers should also be given to the auditors to impose fine on non-performing inspection centres.
- At present validity period for a fitness certificate for a Transport vehicle is stipulated under **Rule 62 of the Central Motor vehicle Rules, 1989**. It is proposed to amend the Rule 62 to prescribe validity period of the fitness certificate both for transport and non transport vehicles as per the following inspection schedule

Vehicle Types	*Frequency*		
	<3 years	3-9 years	>9 years
Private vehicles	NA	Biennially	Annually
Commercial vehicles	Annually	Annually	Annually
	<2 years	2-8 years	>8 years
Motorcycles & scooters	NA	Biennially	Annually

- At present, personal vehicles are required to pay a one-time tax. This concept of "one time tax for life" should be modified and this tax should be payable after a certain time period, synchronising with the period of validity of fitness certificate. Payment of tax and renewal of registration certificate should be linked up so that both these requirements are fulfilled at the same time. **The State Motor Vehicle Taxation Rules** would have to be amended to include these provisions. No tax should be accepted unless a fitness certificate is obtained from an authorised testing station. Non-payment of tax within the prescribed period should be made an offence with severe punishment, including the provision for impounding of the vehicle.
- The details of parameters to be checked at the time of fitness check are given in **Rule 62 of the Central Motor Vehicles Rule, 1989**. This list also needs to be modified to include more items both on safety and environment parameters requiring regular checks. A separate list for items to be checked

in case of CNG vehicles also needs to be incorporated in the Rule 62 as detailed out in the report.

- A Code of practice needs to be prescribed for regulation and control of authorised vehicle testing station under **Rule 63 of the Central Motor Vehicles Rule, 1989.** This code of practice could be formulated based on the model code of practice as suggested in the report

Contents of an Inspection and Certification program

In-service vehicles have to be tested for both safety and emission parameters.

Safety checks

The commercial vehicles are required to undergo fitness checks. Considering the high costs involved in setting up fully automated vehicle inspection centres it is recommended that to begin with there should be a mix of visual tests and automated inspections. The proposed list of basic items to be tested based on visual inspection are given in Table 1.

Table 1 List of automobile components to be tested based on visual inspection

	Visual inspection tests
1.	Steering
2.	Chassis or chassis frame
3.	Fuel tank and piping
4.	Exhaust pipe & Silencer
5.	Bumper bars
6.	Engine mountings
7.	Battery
8.	Security of body
9.	Seatbelts
10.	Condition of body
11.	Tipping gear
12.	Axles
13.	Stub axles, suspension joints, and wheel bearings
14.	Wheel allingment
15.	Road wheel hubs
16.	Tyres

The list of items to be inspected through automated equipment's is given in Table 2

Table 2 List of automobile components to be tested through automated equipment's

S.no	Items to be tested	Tests	Equipment required
1.	Service brakes		
▪	Emergency brakes	Brake test	Brake-Speed combination Tester
▪	Parking brakes		
2.	Silencer	Noise test	Sound level tester
3.	Headlight	Headlight test	Automatic Headlight Tester
4.	Emissions	Free acceleration tests	Diesel
		Idle tests	Gasoline

Formulating stringent emission norms for in use vehicles

Stringent emission norms have been / are being set for newer category of in use vehicles (Euro II and beyond) and therefore, standards would need to be different for old & new vehicles. Norms would depend on technology like 2/4 stroke, cat fit, electronic engine management etc. It has been proposed to make these standards more stringent as per the proposed emission standards given in Table 3. These proposed emission standards are presently under discussion among the relevant Government agencies.

Table 3 Emission standards for inuse vehicles

Category of Vehicles	Type of engine	Current Standard		Proposed standard applicab the vehicles manufactured on after 1st April 2000	
		CO (%)	HC (C6) (ppm)	CO (%)	*HC (C6) (pp
Two/three wheelers operating on gasoline / CNG / LPG	Two stroke	4.5	-	3.5	7000
	Four stroke	4.5	-	2.5	1000
Four wheelers (cars, buses etc) operating on gasoline/ CNG/LPG	With catalytic converter	3.0	-	0.5	200
	Without catalytic converter	3.0	-	1.5	600

For all diesel engine vehicles (naturally aspirated as well as turbo-charged) free acceleration test has been suggested. The current standard as per Rule 115 of CMVR, 1989 is 2.45 m^{-1} or 65 HSU. (Hartidge smoke unit).

Emission checks

To confirm to the in use vehicle emission standards, the in-use vehicle emission control strategy can be considered in two phases. In phase I, it is proposed to have an idle test measuring CO, HC along with lambda, rpm.

In phase II, NO_x measurement is proposed to be added along with other parameters. The proposed test in Phase II is a LOADED TEST (can be transient or steady state). This is being suggested as Phase II as some additional work and time would be required to come up with test methodology for carrying out loaded test. This test will measure the pollutants in terms of MASS & not concentration.

Strengthening Institutional structure

A Centralised comprehensive vehicle inspection program focusing on road worthiness of a vehicle should be introduced in India. International experience has shown that "test only centres", run by single contractor have produced best results.

- The Government should act as a regulator and inspection centres should be run by the private sector.
- The Central Government should frame a regulatory structure specifying lists of tests to be conducted, items to be inspected, frequency for conducting these tests and vehicle inspection fees, defining criteria for selection of private sector for setting up a vehicle inspection centre.
- The State Government should identify the number and location of these centres, identify the private sector to be involved, audit the performance of centres, and should be responsible for on road enforcement.
- The program should be linked to registration/ insurance of vehicles to make it more effective and in making it mandatory. No vehicle should be issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.
- The Central Government needs to identify a nodal agency for emission inventory, regularly monitoring air quality and develop some models to estimate contribution of vehicular air pollution to the total ambient air quality.

Auditing vehicle inspection centres

I&M programmes are often being associated with fraud and corruption. Failure to address these issues will seriously or even totally compromise the effectiveness of I&M system. A well functioning audit and quality assurance system is crucial for acceptance and success of any I&M system. Audit should be done once in six months. The Transport Department would have to set up a team of qualified personnels to audit the performance of these centres. The team should comprise of vehicle inspectors from Transport Department, representative from vehicle inspection centre, an independent auditor appointed by the State Government (preferably an automobile/ mechanical engineer from a reputed research or training institute) with relative good experience in the field. The team would check for:

- Proper presence of necessary equipment and other infrastructure in working conditions
- Proper Inspection procedure being followed by the centre as detailed out in the manual
- Presence of qualified/ trained manpower in the inspection centre.

In India we have number of technical experts who could be used for auditing purposes. A system can be introduced for these auditors to keep updating themselves every two years through the refresher courses and re-valuation. These programmes can be run by research institutes like ARAI, CRRI, IIP Dehradun and VRDE Ahmednagar. The State Governments can pay for the fees for training programme, which can be recovered from the vehicle inspection centre in form of fees/ taxes.

The State Transport Department can prepare a roaster of auditors based on their authorisation certificate and their performance in carrying out the audits. They can design audit plan for all the fitness centres under their jurisdiction. The fitness centres will pay for the cost of the audit. The transport authorities will re-validate the license for the fitness checks based on these audit reports. The audit should cover authenticity of the certificates given, storage, extraction, traceability and security of the data, operator's validity in terms of training, parking area and security of the vehicles etc. This well qualified team of auditors would make random checks in inspection centres to check for proper functioning and operation of the inspection centres.

A penalty system should be imposed for auditing the performance of the inspection centres based on the UK model, where for every different type of offence committed certain penalty points are awarded and after a centre accumulates certain number of penalty points its license is cancelled thus enabling a more transparent form of working of the inspection centre and auditing process. This could include offences like:

- Fraud/ duplicate issue of the fitness certificate
- Improper inspection procedure followed for inspection of vehicles
- Presence of inadequate infrastructure, equipment in the vehicles inspection centre
- Lack of well trained and qualified staff

Enforcement on road

In addition to Traffic Police who would be responsible for checking for vehicles for possession of a valid fitness certificate, mobile checking vans would have to be set up for random checking of vehicles on road. These mobile units would have minimum equipment for checking roadworthiness of vehicle on the road and would have well qualified vehicle inspectors from the Transport Department. Those vehicles found possessing a valid fitness certificate but still not up to the prescribed standards would be sent to the vehicle inspection centre for detailed examination. These vehicles would go to a centre different from previous one and if found not fit would have to pay the fee and go to repair centre for further repairs before getting a valid inspection certificate.

There are other reasons to use Mobile Test Stations; for example part-time use in case of breakdown or renovation of existing fixed Test Stations, road checks on vehicle safety. Another use of Mobile Test Stations can be in areas with lower vehicle density, which makes fixed test stations not economically feasible.

The roles and responsibilities of various stakeholders could be summarised in the table 4

Table 4 Roles and responsibilities

Stakeholders	Responsibilities
Central Government	▪ Amendments in Act ▪ Co-ordinate I&M program ▪ Issue guidelines and manuals
State Government	▪ Incorporate relevant changes in the State Rules ▪ Approve setting up of vehicle inspection centres ▪ Audit performance of centres ▪ Random checking of vehicles on road
Traffic police	▪ On road enforcement

Private sector	Set up inspection centres Grant a fitness certificate
Research institutes	To arrive at test methodology for testing vehicles for mass emission system Emission inventory Design manuals and guidelines Design training modules and conducing training programmes
Vehicle and component manufacturers	Vehicle repair and maintenance program Set up model vehicle inspection centre
NGOs, Media	Consumer awareness campaigns

Setting up vehicle inspection centres

After developing the contents of an inspection and certification program, vehicle inspection centres with 'test only' facilities would have to be set up. These centres would be authorised to inspect a particular category or categories of vehicle. This is essential due to different type of equipment, infrastructure and skill required. The total cost of a vehicle inspection centre for each vehicle category in Delhi and Mumbai is given in Table 5

Table 5: Total cost estimates of a vehicle inspection centre

	Delhi		Mumbai	
	Low cost	High cost	Low cost	High cost
	(in Million Rs)			
2 Wheeler/ 3 wheeler	8.2	10.0	8.8	10.6
Less than 3 Tonne vehicle	9.0	10.7	9.5	11.3
Between 10 Tonne -13 Tonne vehicle	7.1	8.9	7.7	9.5
More than 13 Tonne vehicle	7.4	9.2	8.03	9.8

Inspection fees

An inspection fee has been estimated for different category of vehicles. This has been worked out based on the total cost of an inspection centre and the vehicle handling capacity of an inspection centre. The inspection fees estimated for different types of vehicle are given in Table 6

Table 6 Estimated vehicle inspection fees

Category of vehicle	Estimated Inspection fees	Existing inspection fee
	(Indian Rupees)	
2 Wheeler/ 3 wheeler	485	300
Less than 3 Tonne vehicle	520	300
Between 10 Tonne -13 Tonne vehicle	540	400
More than13 Tonne vehicle	650	500

It is worth mentioning here that the inspection fees calculated is an indicative figure as it has in it in built the land and building cost, which is approximately 20-25% of the total cost. Therefore since the land and building cost varies from city to city and within the city also, an accurate estimation of the cost of establishing an inspection centre is not possible. A city depending on its vehicle fleet composition, might decide to have inspection centres that offer combined testing facilities to various types of vehicles together.

Supporting measures

Human resources development

To introduce an effective inspection and maintenance program it would be necessary that government comes out with a workable training and capacity building program to be organised focussing on the following target groups:

- Staff, attendants and Motor Vehicle Inspector at the vehicle inspection centres.
- Auditors for auditing performance of inspection centres and staff of State Transport Department and the mobile squad for on road enforcement.
- Training should also be imparted to the mechanics in the vehicle repair centres so that they can repair the vehicles efficiently.

Consumer awareness campaign

A consumer awareness campaign should be launched with help of Schools, NGOs, community-based organizations, automobile associations and research institutes. This mass consumer awareness campaign to be run on regular basis should focus on making consumer aware of the following issues:

- Advantages of an inspection and maintenance program for a vehicle owner
- What is the process followed for inspection of a vehicle
- How a vehicle owner must maintain the vehicles
- Frequency of an inspection program

- Locations and list of authorized vehicle testing stations where inspection is carried out
- Roles and duties of a vehicle inspection center
- Location of authorized vehicle repair and maintenance centers
- Legal status of inspection program and fine imposed for offence committed.

Maintenance program

An effective maintenance program is also an essential part of the overall strategy. If a vehicle is found unfit during inspection, it would be awarded an vehicle fail certificate. The vehicle owner has the choice of taking their vehicle to any vehicle repair centre from where they could get their vehicle repaired. The owner would then approach the vehicle inspection centre and would get the vehicle tested for the items on which it failed the test before. The objective here is to develop separate vehicle testing centres and vehicle repair centres. The vehicle manufacturers would need to authorise these repair centres. Less number of well servicing and authorised vehicle repair centres are better and effective than a large number of unauthorised vehicle repair centres. This would ensure that the owners get good repair and maintenance of their vehicles. In addition, the vehicle manufacturers should also give the vehicles owners a detailed manual giving guidelines and tips on maintaining roadworthiness of the vehicles.

Implementation Plan

An implementation plan for introducing these centres in a city is phased manner has been demonstrated for Mumbai city with first phase concentrating on commercial vehicles and then focusing on private vehicle, while ensuring that old vehicles get inspected early.

Further work

Some further work needs to be done in order to effectively implement the I &M program within the broad framework as suggested earlier in this chapter. This includes the following work.

Development of manuals

Detailed manuals need to be developed. These manuals would prescribe the procedure for testing a vehicle, tests to be conducted, and method for conducting the tests and reasons for failures. These manuals would have to be prepared for different categories of vehicles and should be available with all test centres and others concerned with the I&M program.

1. Public service vehicle inspection manual
2. Motor cycle testing manual
3. Car and light commercial vehicle testing manual
4. Heavy goods vehicle inspection manual
5. Trailers and tractors vehicle inspection manual

A handbook for administrators would also need to be prepared specifying roles, responsibilities of the inspectors in the vehicle inspection center, the auditors and other agencies involved.

Training modules

Training modules need to be prepared by research institutes on behalf of the Central Government for the target groups as identified earlier that specifies the contents of the program, schedule of the program, duration of the program, period for refresher courses.

Emission inventory

A framework needs to be developed for monitoring and collecting air quality and vehicular emissions data at regular intervals. A nodal agency needs to given the responsibility of developing this framework , regularly monitoring the data and based on that make recommendations for improving the vehicle mission standards and tests to be done for emission measurement.

More work on tests to be adopted for emission measurement

Further work needs to be done to fix more stringent emission norms for the new category of inuse vehicle. The type of emission tests to be done by the vehicle inspection centres, needs to be identified and the tests modified based on the Indian driving cycle.

Developing tender documents

The Central Government as a regulator would have to formulate guidelines for private sector participation in establishing the inspection centres in India. The State governments would invite the tender from prospective bidders, evaluate them and select successful bidders and award contracts to private parties that are capable of setting up and operating inspection centres in Indian cities.

Setting up model inspection centre

A model inspection centre would have to be set up to demonstrate the procedure for testing the vehicle, list of tests to be done, equipment used and general layout of the centre. A team of experts could monitor the working and performance of this centre and it could act as an opportunity to experiment and come up with a practical and financially viable scheme for replicating such vehicle inspection centres. The Government needs to take an active role and along with help of vehicle manufacturers and research institutes should at the earliest establish model vehicle inspection centre in India.

Implementation schedule

Various measures have been suggested for implementing the Inspection and Maintenance program in India. Table 7 details out the time plan for implementing these sets of recommendations.

Table 7: Time plan for implementing the program in India

	2003-2004 (quarters)				2004-2005 (quarters)				2005-2006 (quarters)			
	1.	2.	3.	4.	1	2	3	4	1	2	3	4
Amendments in relevant Acts	■	■	■	■	■	■	■	■				
Developing contents of an inspection program	■	■	■	■	■	■	■	■				
• Setting standards	■	■	■	■	■	■	■	■				
• Development of manuals		■	■	■	■	■	■	■				
Strengthening existing Institutional structure	■	■	■	■	■	■	■	■				
Develop a model vehicle inspection center			■	■	■	■	■	■				
Detailed work on emissions test procedures		■	■	■	■	■	■	■				
Developing training and capacity building modules				■	■	■	■	■				
Designing consumer awareness campaigns					■	■	■	■				
Developing a maintenance program					■	■	■	■				
Developing tender documents for private sector participation							■	■				
Designing consumer awareness campaigns												
Setting up vehicle inspection centres in a city												

1

Background

The country witnessed a rapid increase in the vehicular population over the last four decades. From a mere 3 million vehicles in the 1960s, the number went up to over 35 million by the end of century. This growth is expected to continue in the coming years also. Large cities, particularly the metros, are facing a higher concentration of motor vehicles than the smaller towns.

Given this rapid increase in the number of motor vehicles on city roads, increasing attention is on the deteriorating air quality. To mitigate the adverse effects of auto emissions, more stringent emission norms (Euro I, and Euro II) are being introduced for all new vehicles. It is expected that these norms will get progressively more stringent. However, these only help to control the emissions from new vehicles and have no effect on the significant emissions from the vehicles already on the roads, or the "in-use" vehicles.

In metropolitan cities like Delhi, a large percentage of the vehicles are old vehicles, and do not meet the present stringent emission norms, therefore it is necessary that emission norms should also be prescribed for the in-use vehicles. Inadequately maintained vehicles can be a cause of road accidents and hence, proper maintenance of such vehicles would not only help in reducing emissions from inuse vehicles, but also increase the safety of vehicles on road.

In case of any emission norms prescribed for the "in-use" vehicles, it is important that there be a mechanism present for certifying that the prescribed norms are being met consistently.

Therefore there is need for a number of inspection and maintenance centres in Indian cities, complemented by an effective institutional and regulatory framework for managing these centres.

Legislative framework

In India motor vehicle operations are regulated through a Central Act known as the Motor Vehicle Act,1988. A comprehensive act was legislated upon in the year 1939 under which powers with regard to various items of operation viz. grant of driving licences, permits, fixation of fee for various services were in the State Governments and to some extent with the Central Government. Even powers concerning important matters like construction and maintenance of motor vehicles were vested in the State Governments under Section 70 of Act.

Position of pre-1988 and other in-use vehicles on road

With reference to the on-road vehicles, Section 56 of the Act provides that a transport vehicle shall be considered validly registered only if it has a fitness certificate. Under Rule 62 of the Central Motor Vehicle Rules, periodicity and other related aspects for grant of a fitness certificate have also been prescribed. Section 56 of the Act also provides that testing of the vehicles may be carried by authorised testing stations/garages in the private sector. The necessary conditions to be fulfilled by a private testing station have also been laid down under Rule 63 of the Central Motor Vehicle Rules. However, these mandatory provisions relate only to transport (commercial) vehicles, which are very small in number. No fitness certificates are provided for personalised vehicles and other two wheelers, which are cause of concern both from safety and pollution angle.

Currently, section 56 of the Motor Vehicles Act, 1988 requires all "Transport" (meaning all commercial) vehicles to have a "Certificate of Fitness". Without such a certificate of fitness, the registration of the vehicle is deemed invalid. As per rule 62 of Central Motor vehicle Rules framed under section 56, the certificate of fitness is valid for a period of two years in respect of new vehicles. Vehicles older than two years have to get a fitness certificate renewed after every year. For tourist vehicles, however, the validity is three years. There is no age ceiling for most categories of vehicles. Under Section 88 (12) rule 88, only goods carriers (commercial vehicles), operating on a national permit, have an age ceiling of 12 years (for 2 axle vehicles). Even in such cases, once the vehicles cross the age ceiling, they are merely withdrawn from the national permit and are used on intra-state or city operations. Thus, even such vehicles contribute to the vehicular pollution and road safety hazards in the cities.

Institutional arrangements

There are only two agencies involved in the process of grant of a fitness certificate. One is the Central Government (Ministry of Road Transport & Highways) which lays policy guidelines under the Central Motor Vehicle Rules. The other is the State Transport Departments, which performs the functions of testing of the vehicles and issuance of the fitness certificate. It is the responsibility of the State Governments to create suitable and adequate infrastructure for carrying out the fitness tests of all the transport vehicles which include buses, trucks, taxis, auto-rickshaws and other vehicles that may be engaging in commercial activity on the basis of a permit and renew the permits of only those vehicles, which have a valid fitness, certificate.

Exiting testing procedure

At present in India, there is no regular fitness-checking programme for the in-use private vehicles. Simple pollution under control (PUC) checks are existing from the year 1991 for all on-road vehicles as per Rule 116 of Central Motor Vehicle Rules, 1989. Commercial vehicles in addition to PUC checks are required to undergo simple fitness checks. However, these tests are isolated checks and are grossly inadequate.

Testing for petrol engines

At present as per the Central Motor Vehicles Rules 115, the standards for idling CO test have been prescribed. The limit is 3 % by volume for all 4-wheeled petrol driven vehicles and 4.5 % for 2 &3-wheeler petrol driven vehicles. PUC centres are presently doing these tests in India.

Testing for diesel engines

As per the present Central Motor Vehicles Rules 115, the free acceleration smoke test is carried for all diesel -engine vehicles on road except those using turbo charged engine. The limit value is 2.45 m-1 light absorption co-efficient.

The new diesel vehicles are tested for different gaseous emissions like CO, HC and NOx as well as particulate emissions while type approval and COP testing, but for inuse vehicles only smoke tests have been prescribed.

Problems with the PUC system

Petrol Engines

- The idle CO tests are prescribed under "PUC" in India. These tests are not giving the expected results due to a number of lacunae in the present system. This is because although the present PUC system is authorised, there are no controlling mechanisms like auditing/ inspecting for these PUC Centres. There are no well-defined criteria for authorising / registering a PUC Centre.
- Idle CO tests are simple tests measuring the volumetric concentration of carbon monoxide while the vehicle is under idling condition. These tests do not measure the mass emissions.
- The idle test does not represent the realistic engine operating condition. At idling, there is no power absorbed from the engine and it is operating at a

low constant speed. When the vehicle is driven on the road, engine has to deliver the power at various speeds depending on the accelerations/ decelerations.

- The major engine control systems for fuelling control (carburettor or fuel injection systems) and ignition control have different operating modes under idling with no load and under driving with varying load.
- The regulatory mass emission test is carried out under a driving cycle test in which the vehicle is driven on a transient driving cycle experienced to road and emissions are measured. As the engine operating conditions are different under these two tests, there is no good co-relation between the idle test and mass emission test.
- The NOx concentration cannot be measured under idling condition as NOx is very low when the vehicle is running at idling. At present only CO, levels are monitored. The other parameter like HC needs to be evaluated from the point of view of engine condition
- As the catalytic converters have been introduced on various vehicles in India for almost 5 years, some tests methods to evaluate the same needs to be developed. The Lambda checking (A/F ratio checking) is one such test used widely. (Based on Discussion with relevant experts and stakeholders)

Diesel Engines

- The free acceleration smoke test for diesel engines is carried out by measuring the peak smoke while the vehicle is in neutral and engine is quickly accelerated to the rated speed and brought back to idling.
- It has been reported that the test results of the testing carried out at different PUC centres do not co-relate because –
- the test variability in these tests is very high as the test involves the transient phenomenon
- The results depend on the operation of the accelerator pedal, which depends on the individuals or the drivers who are accelerating the pedal.
- It is not possible to calibrate the smoke meter under realistic transient condition. The simple neutral density calibration gives very good static check. However, it does not check the sampling system like probes, smoke chamber temperature, pressure etc. Any problem in either of these can give misleading results.
- The smoke test does not represent the complete emission performance of the vehicle especially the NOx emissions. The NOx levels of the diesel engines are quite high

Apart from the specific problems in testing for both petrol and diesel engines, there are also some general issues concerning the existing PUC system in India.

- The PUC centre operators are not given adequate training.
- The equipment are not maintained and calibrated properly.
- There is no central agency to co-ordinate the activities of these PUC Centres.
- PUC test procedure is not followed correctly.

Safety aspects

Present scenario

The new vehicles are extensively tested from point of view of safety. The safety tests include testing of brakes, safety glass, seat belts and anchorage's, signalling and lighting devices tyre tread depth etc. As per the CMV Rules, 62 , Ist Amendment 2001, dated 28 March 2001, some tests have been prescribed for checking safety of the vehicles (Annex B). There are no checking requirements for the in-use personal vehicles except for the commercial vehicles.

Problems with the present system

As there are limited requirements, the vehicles continue to ply on road without any consideration for safety. The numbers of accidents in India is increasing and are quite high as compared to other developed countries, though our operating speeds are low.

There is no data available concerning the accident analysis indicating the type of failures occurring on the road.

Maintenance systems

The inspection programme cannot be complete unless the vehicles, which are found defective, are repaired/ serviced and re-checked.

There are number of roadside mechanics available that may or may not have adequate equipment and training. Vehicle owners still use their services, as they are cheap and available next door. There are no authorised and regular maintenance and repair centres.

It is imperative that proper guidance and service is available to the vehicle user for meeting the overall objectives of improving roadworthiness of in-use vehicles.

Major issues and problems

The irony of the situation is that I&M certification is required only for the smaller number of commercial vehicles and is not required for the much larger number of personal vehicles. Thus, the existing law provides for mandatory fitness certificate only in case of buses goods vehicles, taxis, etc. Even for such a small number of vehicles, the facilities for carrying out the inspection & maintenance are grossly inadequate. As a result, not only do the large number of poorly maintained vehicles contribute to severe air pollution but are also responsible for an increasing number of road accidents. Serious action is, therefore, necessary to control this situation.

Several issues need to be resolved for setting up inspection and maintenance centres. Some of these have been discussed in the following sections.

Legislative arrangements

Earlier, personal vehicles were required to pay the road tax annually in the states in India. Then there was a move to shift away from the annual to one time road tax for administrative and public convenience. This system has since been brought in and personal vehicle owners are now required to pay only a "one-time" tax, at the time of initial registration of the vehicle. Therefore presently there is no mechanism by which it is made mandatory for the personal vehicles to go in for a regular fitness check. To achieve the objective of I&M system one of the methods is to synchronise the periodicity of fitness certificate with the tax payment system. One of the options is to bring about legislative changes is to reduce the validity period of fitness certificate of all categories of vehicles other than commercial vehicles and also appropriately amend the taxation laws by doing away with "one time tax system". The other options include combining the I &M system with the payment of insurance premium.

Regulatory regime for the testing stations

In India, enforcement of the laws relating to motor vehicles is over-seen both by the enforcement staff of the Transport Departments as also the Police authorities. However, none of these two wings of enforcement has facilities for carrying out physical fitness checks of the motor vehicles on road. The officers of these two departments merely check the possession of valid documents while carrying out any field checks. Municipal bodies have no role at all in this regard. Therefore, the enforcement mechanism for checking vehicles confirming to the provisions of the law is very weak in Indian cities.

Auditing performance of these centres is very necessary. The type and quality of the equipment present and presence of technically qualified personals in inspection and maintenance centres would also have to be checked and would be the responsibility of the regulator. It is also essential to check for vehicles on road, which have not obtained their fitness certificate as per the prescribed regulations. Options such as mobile checking units, which would check the possession of a valid certificate with vehicle owners, would also be examined.

Management and financing

A major problem in requiring personal vehicles to obtain certificates of fitness is the setting up of the requisite number of inspection and maintenance centres for carrying out the tests. A major problem in the establishment of the centres will be concerning their ownership and financing. It would not be possible for the government to finance and manage such a large number of centres and might have to set up through the private sector.

Inspection of vehicles

The present PUC system for inspection of vehicles in inadequate. Therefore it is essential to prescribe in detail the contents of an inspection and maintenance program. The different countries follow different pollution tests for in-use vehicles like Accelerated Simulated Mode (ASM), Inspection & Maintenance 240 (IM240), Steady Speed 60 (SS60), raised idle, Lambda checking, VMAS, remote sensing, etc. They also have a mechanism of linking the in-use vehicle test results with the overall pollution and quality objective.

The correct test procedure suitable for Indian conditions, which is optimum from point of view of cost and complexity would have to be selected, based on literature review. The test and all the parameters for testing a vehicle would have to be prescribed. The equipment has to be simple and easy to maintain. Apart from emissions, the systems followed in other countries for checking of safety related components like brakes, silencers, sideslip, lighting & signalling devices, tyres etc. would also have to be studied.

Objectives and scope of the study

As evident from earlier discussion, all of these are complex issues and need to be studied in detail. The objective of this study is to develop a regulatory and management framework for setting up effective inspection and maintenance centres for certifying vehicles for both safety aspects and emission performance. More specifically, the study has made recommendations concerning:

- Legal framework, with amendments that may be necessary to make the Inspection of "in-use" vehicles mandatory and for such vehicles to obtain an inspection certificate from an authorised I&M centre
- Institutional mechanism to set up and control these centres
- Identification of the specific items to be inspected. This should comprise of a comprehensive set of items, including both safety aspects and emissions performance.
- Essential equipment requirements at the I&M centres
- Requirements in respect of manpower and training for the staff of the I&M centres and others involved in the program.
- Arrangements for monitoring the performance of the centres and for auditing the quality of inspection carried out by the centres.
- Financial viability of the centres. This would also explore the possibility of securing public-private partnerships in setting up the I&M centres.

Methodology

Literature review

Legal framework

A review of the current legal framework for I&M in India has been done covering the following Acts and Rules:

- Motor Vehicle Act, 1988
- Central Motor Vehicle Rules, 1989
- Motor Vehicle Rules of relevant states

The objective was to review what are the current provisions in the Act for I&M. This covered what types of vehicles are covered under the I&M schemes, the list of tests that should be performed (covering various parameters) and the frequency of conducting these tests and the penalties that are imposed if a vehicle does not possess a valid fitness certificate.

Institutional arrangements

A review of existing institutional arrangements has been done to cover the roles, responsibilities and functions of Central Government, State Government (Transport Department) and the Private sector in inspection and maintenance of in use commercial vehicles. Discussions with relevant stakeholders have been done through personal interview and questionnaire survey so as to assess the problems and issues in implementing these I&M schemes.

A review of existing status of I&M scheme in Delhi and Maharashtra has been carried out. This included visiting some of the existing Inspection and Maintenance centres and asses the existing ground situation in comparison with what facilities, equipment, and manpower should ideally be present in the centre as per the rules and regulations for testing a vehicle on both safety and environment parameters. A copy of the questionnaire is given in Annexe A. A review of the current PUC system in India has been done to assess the problems and issues of the existing system in detail. This involved personal interview and discussions with the transport department, persons running these PUC centres and a sample of vehicle owners.

The literature review also covers similar work/studies done earlier for India. This includes the "Julian David" report and the "Road map for inspection and maintenance of in use vehicles" developed by SIAM/SAFE.

International literature review

A literature review of the Inspection and maintenance system prevailing in other countries like Japan, Singapore, USA and UK and some of the other Asian countries have been done based on secondary data available to identify the alternative institutional arrangements, inspection and maintenance program for of inuse vehicles.

Analysis and Recommendations

Based on the existing status of I&M program in India and type of systems prevalent in other countries emerging from the international literature review, the following aspects of an inspection and maintenance program have been assessed and analysed to come up with recommendations for setting up an effective inspection and maintenance regime in India. Based on the literature review a comprehensive I&M program for in use vehicles in India has been developed.

1. Contents of an Inspection and Maintenance program for certifying different categories of vehicle for fitness based on environment and safety parameters for both commercial and private vehicles has been developed in detail. This includes:

    - The list of tests for inspecting a vehicle on both safety and environment aspects that should be carried out on different categories of vehicles

- The list of equipment that should be used for performing the tests on various parameters.
- The frequency for conducting these tests for different categories and vintages of the vehicles.
- The manpower and the associated skill/ training requirements
- The benefits that would accrue to a vehicle, which has undergone these tests for attaining the fitness certificate

2. Changes or modifications that are required in the current regulatory structure and / or amendments in the relevant acts for institutionalising an effective I&M program including various mechanisms for enforcement have been suggested.

2

Literature review

This chapter details out the national review of the inspection and maintenance system in India and reviews some of the studies done earlier and strategies suggested to improve the existing system in India. International experience of some of the countries where such a system has been successfully implemented has been reviewed and lessons have been drawn for India.

National

Legislative Background

Amendments in Motor Vehicles Act, 1939

In view of rapid development of road transport in the late eighties and a large increase in the number of motor vehicles, resulting in increased number of road accidents, the government paid attention to the technical aspects of a motor vehicle and in the year 1982 brought about comprehensive amendments to the Motor Vehicle Act, 1939. Among various provisions brought through the 1982 amendment, it as provided under Section 69B; the powers to make rules for regulating the construction, equipment and maintenance of motor vehicles and trailers shall be vested with the Central Government. However, such powers were restricted only with reference to (a) the width, height, length and overhang of vehicles and of the loads carried; and (b) the size, nature and condition of tyres. The powers to make rules with reference to other important aspects like brakes and steering gear, signalling appliances, lamps and reflectors, speed governors, the emission of smoke, visible vapour, sparks, ashes, grit or oil, reduction of noise levels, periodical testing and inspection of vehicles by prescribed authorities, etc. remained with the State Governments under Section 70 of the Act of 1939. It would thus be seen that almost all-important matters with reference to a safe and non-polluting vehicle remained with the State Governments.

Evolution of 1988 Act

The Motor Vehicles Act, 1939 has been amended several times. Various high powered Committees including the Law Commission went into different aspects of road transport. These bodies recommended updating, simplification and rationalisation of this Act. Therefore the Government in January 1984 to review all the provisions of the Motor Vehicle Act 1939 constituted a working group. This working group took into account the suggestions and recommendations earlier made by various bodies, institutions, transport organisations and the vehicle manufacturers. The working group among various other recommendations, emphasised the need for encouraging adoption of higher technology in automotive sector and concern for road safety standards, pollution-control measures, standards for transportation of hazardous and explosive materials. Based on the recommendations of the working group, the present Act of1988 was brought in. Section 110 of this Act empowered the Central Government to make rules on all matters relating to construction and maintenance of a motor vehicle which were hitherto with the State Governments under Section70 of the 1939 Act.

Central Rules relating to safety and emission aspects

In exercise of the powers vested with the Central Government under Section 110, the Central Government came out with a comprehensive statute known as Central Motor Vehicle Rules, 1989. These rules came into force in July 1989 and apart from various administrative issues, also prescribed standards of important components and vehicular emission. It has also been provided under Rule 126 that the prototype of all vehicles shall be tested by any one of the specified testing agency viz. Automotive Research Association of India, Pune, Vehicle Research & Development Organization, Ahmednagar, Indian Institute of Petroleum, Dehradun. Norms for exhaust emission standards for various categories of vehicles, both petrol and diesel driven vehicles have also been prescribed under these rules.

It would be relevant here to mention the legal position regarding operation of vehicles and the stage at which /categories of vehicles for which a fitness certificate is required. It is necessary that before a vehicle can be allowed to operate on road, it should have been duly registered as per procedure laid down under Chapter IV (Sections 39-65) of the Act. Subsequently, as per chapter V of the Act, any vehicle which is to operate as a transport vehicle i.e. to engage in commercial activities, has to obtain a permit from the State Transport Authorities. The necessity of obtaining a fitness certificate is only in respect of transport vehicles. Even under the 1939 Act, this requirement was limited to transport vehicles only. So far no provision has been made for obtaining a fitness certificate by non-transport (private vehicles). As per Sec.41 (7) of the

Act, a certificate of registration issued in respect of a motor vehicle, other than a transport vehicle, is valid for a period of fifteen years from the date of issue and is renewable. It would thus be seen that though the certificate of registration of a private vehicle is renewable, there is no obligation on the owner to obtain a fitness certificate before renewal of the registration certificate. The position under the earlier Act of 1939 was also same (Sec.24 of Act of 1939).

The significant change brought under the Act of 1988, with reference to provision of certificate of fitness of transport vehicles, is that while under Sec.38 of the Act of 1939 a specific period of validity of the certificate had been provided under the Act itself, under Sec.56 (3) of the Act of 1988, the powers to prescribe the period have been vested with the Central Government. Further, under the Act of 1988, powers to issue certificate of fitness have been vested in the private testing stations as may be approved by the State Government. In a way the new provisions are more flexible and also open scope for creating testing facilities in the private sector.

The central government has prescribed period of validity of certificate of fitness and other relevant conditions under Rule 62 of the Central Motor Vehicle Rules, 1989. These rules are applicable on uniform basis throughout the country. Through a recent amendment of March 2001, the Central Government has also identified certain items for which a test is necessary. Extracts of Section 56 of the Motor Vehicles Act, 1988 and Rule 62-63 of the Central Motor Vehicles Rules, 1988 are given in Annexe B.

As per existing legislative framework, as briefly discussed above, it would be seen that in the matter of grant of a fitness certificate, the State governments have no role except to recognise private testing stations (garages) for issuance of Certificate of fitness for transport vehicle. However, so far no private testing stations have been identified/approved by the State Governments because the operation of this law had been stayed by the Calcutta High Court. The apex Court has since vacated this order of the High Court. Inspite of all constraints and other limitations, at present fitness certificates are granted by the government test agencies only which are a part of the State Transport Department.

Review of earlier studies

Julian David Report

In March 1999, Julian David conducted a study on "Vehicle inspection – issues and options and a possible blueprint for India".

Recommendations of Julian David report

Getting garage and workshop owners to build new or upgrade existing facilities will take time and require a considerable change in approach by most owners. Although this route is feasible, and may be the only alternative for remote areas, it does not meet the requirement for early action in the major population centres.

The best solution in the short to medium term for the metros and towns that have a large enough vehicle population to warrant full time facilities is to have dedicated inspection centres. With the right approach and sufficient will, such centres could be operational in a relatively short time.

This approach is not suitable for the smaller towns and rural areas where the vehicle density is not high enough to merit an inspection centre. The choices for these vehicles are –

a) Make them travel long distances to the larger towns;
b) Provide mobile inspection centres;
c) Conduct simplified inspections using the facilities that are available;
d) Exempt them until local facilities can be provided.

Option (a) is not likely to be a politically acceptable alternative. Mobile inspection facilities (option (b)) are expensive to buy and to operate. They are unlikely to be cost-justified. Exempting vehicles (option (d)) may be acceptable as a temporary measure but it is unacceptable in the longer term, as it would provide a loophole that would undermine the effectiveness of the scheme unless the location of operation of these vehicles could be limited to the rural areas. This is not likely to be either practical or politically acceptable.

Provision of capital

Using a private sector approach would relieve the public sector of the capital requirements of setting up the inspection scheme. Given the high number of competing demands for public capital in India, it is likely that the use of private capital to fund inspection facilities would be welcomed. The best solution for India would be for the private sector to provide the personnel and to run the inspection centres. Provided careful tendering processes are used, this approach is more likely to give the lowest cost inspection and the least long term management and supervisory problems for the public authorities.

Having the inspectors independent of any commercial interest in the vehicles they are inspecting helps maintain public confidence and minimise supervision problems.

It is most unlikely (and in any case undesirable) that any one private organisation could take on the inspection activity for the whole of India. It becomes more possible at the state level. However some competition is helpful to provide a downward pressure on fees and an upward pressure on the service provided to vehicle owners. Having more than one contractor gives the opportunity to compare performance. On the other hand, in areas where the vehicle density is not high, it may not be economically viable to have two inspection centres. If more than one contract is let the inspection fee has to be predetermined.

A possible solution is to let a number of contracts for defined geographical areas that overlap where vehicle densities are high but not where the density would be insufficient to support more than one economic facility.

Phasing

Since all vehicle types have the potential to influence both air quality and road safety, it is desirable that they should all be subject to inspection. Ideally inspection should commence with all vehicles types at the same time. If this is not possible for practical or political reasons, the introduction of inspection will need to be phased. Given the number of vehicles that need to be brought into an inspection scheme in India, it is inevitable that some phasing will be necessary. Phasing by vehicle age, type and location and by inspection content and standard is possible.

Phasing by age is relatively straightforward and logical. The older vehicles are more likely on average to be the ones most badly maintained and hence there is justification for inspecting then first.

Although there are some unique features, there is no reason for the inspection content and standards used in India to be fundamentally different to those applied elsewhere. The basic road safety and environmental needs are the same. Some minor adjustments will be necessary to take account of the Indian vehicle construction standards.

Commercial vehicles are required to be re-registered every year, so there is an opportunity to check at the time of re-registration that a current inspection certificate is in force. However, effectiveness of this check will be undermined if significant numbers of vehicles do not comply with the re-registration obligation or the process is not performed effectively.

For private vehicles there is currently no requirement to re-register every year, only when the vehicle is 15 years old. The most effective option would be to introduce an annual re-registration requirement. This will increase costs, complicate and possibly delay the process of introducing inspection for this class of vehicles. It may not be politically acceptable particularly if the cost of running the registration scheme falls on the public sector.

Another means may have to be found. These vehicles have to be insured every year so it may be possible to persuade the insurance companies to check inspection certificate validity. However this will increase insurance costs as the companies will require compensation for the additional work.

There should be no fundamental difficulties with enforcing inspection standards in India. Ensuring that the right controls and supervisory arrangements are applied to the organisation conducting the inspection can be used to enforce the standard of the test. These controls will include requirements to have independently approved and monitored management and quality systems. The inspectors must be properly supervised, have adequate experience and be properly trained and remunerated. There should also be an element of independent verification of the quality of inspection by a programme of unannounced re-inspection of a proportion of vehicles that have been inspected.

A comprehensive list of items to be inspected, method and principal reasons for failure and estimated cost of an inspection centre form part of the report of Julian David. (David, 1999)

SIAM/ SAFE report

Society of Indian Automobile Manufactures (SIAM) and Society for Automotive Fitness & Environment (SAFE) have conducted another study on this subject. The study had been conducted in August 2000. In this study it has been recommended that for an effective implementation and control of I&C centres, India should follow the centralised system, as has been successfully demonstrated in man y other countries. SIAM-SAFE study also emphasise the need for bringing all categories of vehicles under the scope of I&M. and that such activities should be entrusted to private sector also.

The centres in such centralised system can be inter linked with computers and hence monitored centrally for effective administration and control of vehicle fitness certification programme.

This study has also prescribed phased programme to be adopted for testing of different categories of vehicles. Like Julian David, SIAM/SAFE have also projected estimates of cost of a three lane I&C centre for buses, trucks, taxis and autos. The SIAM/SAFE study has also not suggested any new tests other than those mentioned in the government notification. They have however, suggested a comprehensive code of practice for the operation of authorised testing stations for motor vehicle fitness certification which is essential in Indian conditions. (SIAM and SAFE, 2000)

International

An extensive review of the existing inspection, certification and maintenance system has been done for Asian, European and North American countries which highlights the Institutional and regulatory framework being adopted by each country for implementing the program, contents of the program the type of tests being conducted for parameters on safety and environment features.

Japan

Japan is the top most or the second largest motor vehicle producing country in the world and the motorization in Japan is remarkable. The number of registered motor vehicles was 72.03 million at the end of 1996 (with 46.87 million passenger cars 20.22 million trucks, and 4.94 million others). This represented an increase of 21.75 million in the past decade. The number of motor vehicles is deemed to show a further increase in Japan centred on passenger cars, on the ground that propagation of passenger cars to motor vehicle motor vehicle is still behind those in U.S.A. and Europe.

Contents of the program

A decentralised program is being operated in Japan focusing on both safety and environment parameters.

Environment:
- CO
- HC

Safety:
- Seat belts
- Brakes
- Visual inspection

In Japan the total inspection is automated through a single channel. The tests are divided in five blocks Block-A to Block-E till the total evaluation is over. The Block A consists of visual confirmation test, Block-B and Block-C consists of inspection by test equipment, Block-D consists of under body inspection (pit type), and Block-E consists of control room for inspection equipment.

Institutional and regulatory framework

For light and medium vehicle inspection are done by private sector. For heavy vehicles inspection is responsibility of Ministry of Transport. The Government of Japan has established 222000 shops just for repair and maintenance and also given approval for inspection to about 61700 private service centres.

The inspection certificate is taken to a government vehicle inspection and registration centre, where one gets his registration renewed. A safety regulation conformity certificate from the designated approved inspection centre can be presented before motor vehicle registration and inspection centres. There are such 38 motor vehicle registration and inspection centres in Japan.

Motor vehicles are inspected regularly to confirm their structure and equipment with safety regulations. This increases vehicles safety and prevents pollution while enabling smoother road traffics and saving more energy at the same time.

Users of motor vehicles are socially responsible to maintain their vehicles safe and pollution-preventable. The Road Vehicles Act defines "Safety Regulations for Road Vehicles" that all vehicles must be complied with at all time.

Legal requirements for operation

No motor vehicle, that is subject to inspection can be operated unless it has undergone inspection conducted by the Ministry of Transport (or by the Light Motor Vehicle Inspection Organisation authorised by the Ministry in the case of mini-sized motor vehicles) and is provided with a motor vehicle inspection certificate. (Motor vehicle inspection and registration guide)

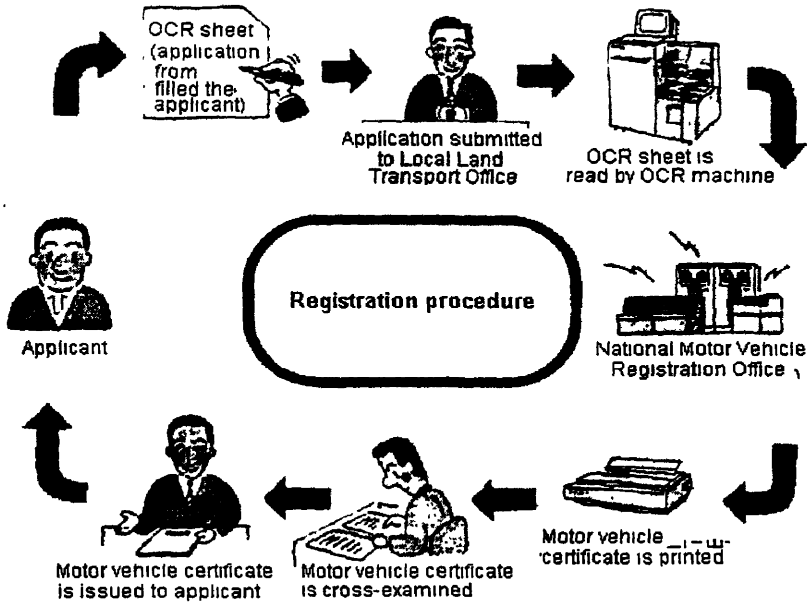

OCR sheet (application from filled the applicant)
Application submitted to Local Land Transport Office
OCR sheet is read by OCR machine
Applicant
Registration procedure
National Motor Vehicle Registration Office
Motor vehicle certificate is printed
Motor vehicle certificate is cross-examined
Motor vehicle certificate is issued to applicant

Figure 2.1 Registration process

Inspection tests

Besides the motor vehicles that are subject to registration, three-wheeled/four/wheeled mini-sized motor vehicles and small-motor cycle are obligated to undergo inspection. As of the end of December 1996, motor vehicles that are subject to undergo inspection totalled 52.29 million, and this represents an increase of 15.09 million during the preceding decade. (JMEA, 1999).

The further details on the Inspection and Maintenance program in Japan are given in Annexe C on International literature review.

Singapore

Background

Singapore faced an explosive demand for the transport during the late seventies and eighties. During this period, while road network grew by 27%, car population alone grew by 10% per annum.

Emission intensity of older vehicles, other things being equal, is likely to be more. In Singapore, measures have been employed to discourage the use of old vehicles. The life of certain vehicles is fixed, at the end of which the vehicles must be scrapped. The certificate of entitlement is valid for a period of 10 years, after that it has to be revalidated either after 5 or for 10 years. If revalidation is done for 10 years one has to pay full Prevailing Quota Premium (PQP). If revalidation is done for 5 years one has to pay 50% PQP.

Contents of the program

A Decentralised inspection and maintenance program is being operated in Singapore. A complete roadworthiness inspection in accordance with requirements under the Singapore legislation. The inspection consists of comprehensive test items, the details of which are given in Annexe C.

Institutional structure

A number of agencies approved by the local transport authority LTA conduct these inspection tests in Singapore. They are not maintenance/repair centres. In Singapore private sector is also authorised to collect road tax and conduct vehicle ownership transfer on behalf of the local authority in addition to its motor insurance services, making it a one-stop service centre for the convenience of the motoring public.

Through its highly computerised and integrated equipment, a comprehensive and up-to-date database on inspected vehicles and inspection results is maintained. This enables the company to churn out customised statistical details from the database to the local authority for the formulation of land transport policies such as inspection standard and frequency. According to the officials in LTA approximately 20% of the vehicles fail the tests in the first instance. These vehicles are sent for repair and called again for inspection until they can pass all the tests. There is no fine on vehicles that fail the tests.

The road worthiness certificate is given by the private centre is also sent to Land transport authority and are regularly audited by them. These private centres are authorised to grant the registration certificate and even conduct training for the staff.

Inspection tests

Frequency of tests

The inspection notice is given from the Land & Transport Authority three (3) months before the road tax expires. The frequency on inspection tests is given in table 2.1.

Table 2.1: Frequency of inspection tests in Japan

Frequency of Inspection tests					
Vehicle Types	Frequency			Inspection Fees	
	<3 years	3-10 years	>10 years	First Inspection	Subsequent Inspection
Motorcycles & scooters	NA	Annually	Annually	S$15	S$8
Cars & stationwagons	NA	Biennially	Annually	S$54	S$27
All tuition cars	Annually	Annually	Annually	S$54	S$27
Private hire cars	NA	Biennially	Annually	S$54	S$54
Taxis	6-monthly	6-monthly	NA	S$54	S$27
SBS buses	6-monthly	6-monthly	6-monthly	S$60	S$30
TIBs buses	6-monthly	6-monthly	6-monthly	S$60	S$30
CSS buses	6-monthly	6-monthly	6-monthly	S$60	S$30
Other buses	Annually	Annually	Annually	S$60	S$30
Light goods vehicles (MLW <3,000 kg)	Annually	Annually	6-monthly	S$54	S$27
Heavy goods vehicles (2 axles)	Annually	Annually	6-monthly	S$60	S$30
Heavy goods vehicles / buses / trailer with prime mover (>2 axles)	Annually	Annually	6-monthly	S$65	S$35
Trailers	Annually	Annually	Annually	S$50	S$25

Source: www.lta.gov

The further details on the Inspection and Maintenance program in Singapore are given in Annexe C on International literature review.

New York

Contents of the program

A Decentralised inspection and maintenance program is in New York covering both environment and safety aspects.

Institutional structure

Official inspection stations are registered by DMV and display yellow and black "Official Inspection Station" signs. The inspection stations are listed in the telephone directory yellow pages. Most vehicle repair shops are licensed inspections stations and display the yellow and black "Official Inspection Station" sign.

Private sectors are authorised by the state government

- Motor inspection centres are separate. They display yellow and black "Official inspection station sign. Separate centres for diesel and gasoline vehicles.
- Authorised motor vehicle repair shop displays a green and white "Registered motor vehicle shop" sign
- The DMV issues licenses to both inspection and maintenance centres. These are issued separately for gasoline and diesel vehicles.

Inspection tests

A vehicle must pass the emissions test to receive an inspection sticker, and a vehicle that does not pass may be denied a registration. The vehicle must be repaired to meet the standards and pass a re-inspection. If repairs costing $450 or more are made and the vehicle still fails, a one-year waiver may be issued. Vehicles less than two model years old, or more than 25 model years (e.g. a 1975 model in 2001), diesels, electric vehicles, motorcycles and vehicles with historic or farm equipment registration are exempt from emissions inspection. Annual safety inspections are still required for all vehicles unless otherwise exempt by law.

Penalties

If an inspection sticker is on the vehicle, but expired within the last 60 days, the fine is between $25 and $50. If no inspection sticker or expired more than 60 days, the fine is between $50 and $100. There is also a $30 mandatory state surcharge in addition to the fine. Also, failure to have an inspection may result in denial of your vehicle registration. Failure to have a valid inspection sticker on a parked vehicle may also result in a parking violation.

Vehicles exempt from the test

Vehicles less than two model years old, or more than 25 model years (e.g. a 1975 model in 2001), diesels, electric vehicles, motorcycles and vehicles with historic or farm equipment registration are exempt from emissions inspection. Annual safety inspections are still required for all vehicles unless otherwise exempt by law.

If a vehicle fails inspection

A vehicle must pass the emissions test to receive an inspection sticker, and a vehicle that does not pass may be denied a registration. The vehicle must be repaired to meet the standards and pass a re-inspection. If repairs costing $450 or more are made and the vehicle still fails, a one-year waiver may be issued. This repair cost threshold will be adjusted annually with the Consumer Price Index. (New York State Motor vehicle safety and emissions inspection program)

The further details on the Inspection and Maintenance program in New York are given in Annexe C on International literature review.

Illinois

Contents of program

A Centralised inspection and maintenance is operational in Illinois mainly focusing n environment parameters of CO, HC, NO. The Illinois Environmental Protection Agency's (EPA) enhanced vehicle emission test program improves air quality and implements pollution reductions required by the federal Clean Air Act Amendments of 1990. Although Illinois has made significant strides to clean its air since the Amendments took effect, levels of air pollution in the Chicago and Metro-East St. Louis metropolitan areas still exceed safe standards.

Institutional structure

There are 35 motor vehicle inspection centres. The Vehicle owners can get their vehicles repaired from authorised private repair centres. Different authorised shops are present for repairs.

Inspection tests

Vehicles are tested every two years, beginning when the car is four model-years old. The station inspector gives you a report containing detailed test results. The vehicle will need to be repaired and returned for re-inspection. The Illinois EPA recommends that emissions-related repairs be made by a recognised technician trained and experienced in emissions diagnosis and repair. If the repaired vehicle fails the re-inspection, the owner can apply for a waiver for the current test cycle. The average vehicle that fails the initial test will most likely not require $450 worth of repairs. It is estimated that the average repair cost will be about $150 — roughly the cost of an emissions-related tune-up. (Illinois EPA 2001).

The further details on the Inspection and Maintenance program in Illinois are given in Annexe C on International literature review.

Arizona

Contents of program

A Centralised inspection and maintenance program is they're focusing on environment parameters of Co, HC, opacity, NO.

Institutional structure

Vehicle owners can get their vehicles repaired from authorised private repair centres. Different authorised shops are present for repairs. Although it is not required, it is suggested that a failing vehicle should be taken to a repair facility that has the equipment to diagnose today's sophisticated vehicles. Each test station has a list of recognised repair facilities that have met basic minimum qualification, and have achieved a reasonable rate of success in repairing vehicles to pass the emission test. After all necessary repairs are performed; the vehicle shall be taken to the test station for its free retest. To receive the one free retest, it must be retested within 60 days of the first test. The 60 days allowed for the free retest does not relieve the vehicle owner from
Registration requirements. However, late registration fees would be assessed if the vehicle is passed, and the registration is processed within 30 days of the initial test, provided that the initial test is accomplished within the vehicle's re-registration month

Inspection tests

Frequency of tests

Beginning in 1995, most vehicles in metro Phoenix began an Enhanced Testing program that requires test only every other year. Metro Tucson continues with annual testing.

Maintenance schedule

The owner of a diesel vehicle that has failed the emissions test twice, and who has attempted repairs that meet or exceeded the maximum repair cost limit, can apply for a waiver. Waivers are only granted once in the lifetime of a vehicle since Jan. 1, 1997. (Fleet Vehicle inspection program for Arizona)

The further details on the Inspection and Maintenance program in Arizona are given in Annexe C on International literature review.

United Kingdom

Background

Compulsory vehicle testing was introduced in Great Britain in 1960 when the Motor Vehicles (Tests) Regulations 1960 came into operation. The test was initially confined to vehicles that were ten years old or more, but the testable age was progressively reduced to three years by April 1967. On 1 January 1983 the testable age for ambulances, taxis and vehicles with more than eight passenger seats, excluding the driver's was reduced to one year.

Contents of the program

MOT's are undertaken at garages authorised by the Vehicle Inspectorate to carry out the tests. They are easily identifiable by the blue, 3 triangle MOT Sign. The inspection program in UK covers both the parameters on safety and environment. (Vehicle Inspectorate 1999)

Institutional structure

The Vehicle Inspectorate administers the MOT test scheme on behalf of the Secretary of State. This role includes the following functions:

a. documenting test methods and standards;
b. documenting the standards of facilities, equipment, repute, experience, competence, qualifications and administration necessary for those carrying out MOT testing;
c. authorising those who meet the necessary standards to carry out MOT testing;
d. providing training in test methods and administration to those who will be involved in the operation of the MOT test scheme – standards are agreed with the Department of Environment, Transport and the Regions;
e. supplying test certificates and other relevant documents as required and, where appropriate, agreeing the specification or recommending the format of other documents;
f. monitoring the performance of those carrying out MOT testing and advising, training or disciplining where standards are not maintained;
g. conducting statutory appeals against test failures;
h. Investigating complaints about testing standards.

Repair and maintenance

If the vehicle fails the test a notice of refusal of a test certificate is issued. If the vehicle's previous test certificate has expired, then once the vehicle has returned home, it may not be used on a road until it passes a test and has a test certificate issued. The testing station (VTS), which will usually be a private company, has no authority to take any action other than to refuse a certificate. It has no prosecution or prohibition powers.

Enforcement mechanism

Transport Commissioners are responsible for enforcement of vehicle inspection programs in UK. VI undertakes a number of enforcement activities including;

Roadworthiness of vehicles and enforcement of traffic regulations

Mainly covering roadside and other spot checks of vehicles and issue of prohibitions to defective vehicles; inspections at the roadside, ports and elsewhere for overloading, vehicle excise duty and other road traffic offences; inspection and analysis of tachograph charts; the follow up investigative work and prosecutions; advising the traffic commissioner regarding operator licensing and vehicle maintenance.

Supervision of the MOT Testing Scheme

This scheme covers the inspection of new premises and the assessment and training of prospective authorised examiners (AE's) and nominated testers (NT's). Supervisory work involves regular inspections aimed at maintaining test standards, assisting AE's and NT's resolve problems and where appropriate take action against garages that fail to comply with the requirements.

Accidents and Defects

Conducting Roadworthiness inspections on vehicles involved in accidents where it is suspected that there may have been a contributory mechanical defect. Investigating reports of alleged safety defects in vehicles and components. In the case of serious recurring safety faults manufacturers conduct a recall under the code of practice for vehicle safety defects that is administered and supervised by VI.

At any time after a license has been granted the traffic commissioner may direct that it be revoked, suspended, or that its scope be reduced on several grounds including on convictions relating to maintenance of vehicles in a fit and serviceable condition. Vehicle examiners (employed by the vehicle inspectorate) provide the traffic commissioner with a technical assessment of licensed operator's maintenance arrangement. (Department of Transport, UK 1995)

VI staff visits VTS to audit them in different ways;
a) they visit on a pre-arranged basis and check the paperwork, equipment, security of documents, equipment condition and calibration evidence. They also check the tester's continuing competence by observing them carry out a test. They may also retest a vehicle that has been tested at the VTS, which is still on the premises.
b) A VI Examiner who is not known to the VTS may visit posing as an ordinary customer. They ask for their car to be tested and watch how the tester carries out the test. If the test is satisfactory, the Examiner leaves without revealing his identity. If the test is not carried out correctly, the Examiner announces himself and disciplinary action follows. This is called an incognito test. The standards of discipline applied are those outlined in the Guide.
c) Sometimes VI staff observes a VTS from a distance. E.g. using a disguised van. The observing staff take note of all the vehicles that go in and out of the VTS and how long they stay for and, if possible, watch to see whether they are actually tested. At the end of the day, the observing staff go into the VTS and check the records for the day to see if they match up with what they observed. This detects the issue of certificates to vehicles that have not been tested, perhaps have not even visited the VTS.
d) A VI Examiner can call unannounced at a VTS and re-examine a car that has just been tested to check that the correct standards have been applied.
e) VI staff conduct roadside checks on cars that are in the vicinity of a VTS. This monitors in-use vehicles and can uncover recently tested that should not have passed.

Regulatory framework

Sections 45 to 48 of the Road Traffic Act 19888 proved the legislative basis for MOT test. The Vehicle Inspectorate under the Regulations issues this Guide and the MOT Inspection Manuals. There are five types of inspection manuals:

1. The MOT testing guide: A handbook for scheme administrators
2. Public service vehicle inspection manual
3. Motor cycle and side car testing manual
4. Car and light commercial vehicle testing manual
5. Heavy goods vehicle inspection manual

All Authorised Examiners (AE) agree as a condition of authorisation that they understand and accept those requirements. Heavy goods vehicles (HGVs), some goods carrying trailers and certain other goods vehicles such as articulated vehicles are tested under Section 49 of the Road Traffic Act 1988.

Inspection tests

The purpose of the MOT test is to ensure that cars, other light vehicles (including some light goods vehicles), private buses and motorcycles over a prescribed age are checked at least once a year to see that they comply with key roadworthiness and environmental requirements in the Road Vehicle Construction and Use Regulations 1986 and the Road Vehicle Lighting Regulations 1989 as amended. (Department of Transport, UK 1995)

Awareness campaign

The Department of Transport along with the vehicle inspectorate, the freight transport association, the road haulage association and Confederation of Passenger transport has prepared a guide to maintaining road worthiness for commercial goods and passenger carrying vehicles. The guide has been produced for all those who are responsible for operating, maintaining or providing commercial goods and passenger carrying vehicles. The guide describes a system for maintaining vehicles in a roadworthy condition regardless of operating conditions, fleet size or vehicle type. It is particularly applicable to new and established operator license holders as it incorporates the procedure necessary to satisfy the requirements of Traffic Commissioners. Different methods have been prescribed for maintaining vehicles in a roadworthy condition. Recommendations have also been given to take advice and help from the traffic commissioners or the Vehicle Inspectorate. (Department of Transport, UK 1995)

The further details on the Inspection and Maintenance program in United Kingdom are given in Annexe C on International literature review.

Lessons learned

Based on the literature review of selected countries as discussed earlier and experiences of a few other Asian countries like Malaysia, Hongkong, China and Philippines, the following lessons have been drawn for India.

Contents of Program

In most of the countries, a total roadworthiness test is carried out for granting a vehicles fitness certificate. It covers both safety and environment aspects. In India also it would be beneficial to focus on a total road worthiness test. It might be worthwhile to introduce more detailed tests that are costly and complicated in a phased manner at a later stage covering all types and categories of vehicles.

Decentralised Vs Centralised programs

Centralised programs require all inspections to be done in stations specialised in emissions testing and safety inspection with no vehicle repair facility. The characteristics of the Centralised programs are:

- Vehicles must be inspected at a government run or contracted inspection centre
- If a vehicle fails inspection, driver has to take it elsewhere for repair and returns to station for re-inspection.
- Manageable numbers to audit and staff is specialised for the purpose of inspection only.

Decentralised programs require both inspection and repair being done at the same centre in private garages. The characteristics of the Decentralised programs are:

- Large number of private garages allows vehicle owners to drive shorter distances for inspection.
- Inspections may lack the accuracy of automated centralised stations.
- Less expensive to set up as compared to centralised stations
- Qualities of inspection repair and experience of staff very unreliable and difficult to regulate.

The comparison of the two types of systems based on some of the parameters has been done in the Table 2.2.

Table 2.2 Comparison of Centralised and Decentralised inspection and maintenance program

	Decentralised	**Centralised**
Skill competence	Low	High
Improper inspections	High	Low
Possibilities of fraud	High	Very low
Management cost (Bangkok case)	High	Low
Consumer satisfaction	Low	High

Source: Faiz (2001)

A study conducted by U.S. Environment Protection Agency in 1999 compares the cost of I/M Program in a centralised and decentralised systems. As per their results, the cost of an inspection tests in a decentralised system is two to three times more as compared to inspection tests in a Centralised system. (US, EPA 1999)

Both Centralised and Decentralised inspection systems have its advantages and disadvantages. Despite its disadvantages, a decentralised system has also been successful in some of the countries due to presence of a strong regulatory and enforcement mechanism. In fact, apart from Centralised and Decentralised system a hybrid system can also be implemented, which has elements of both the systems. An example could be High volume "Test only" stations and low volume "repair and retest stations".

Structure of the program

- International experience has shown that "test only centres", run by single contractor have produced best results. Test and repair garages can be seen to be very convenient for the vehicle owners and easy to set up for the Authority but in practice proving to be highly flawed. No garage will tell his client that he does not have the technical ability to repair the vehicle and pass the test. To save face, he will always prefer to cheat on the test. Ten 5-lane test-only centers have the same test capacity as 120 test and repair centers and are obviously far easier to control. They facilitate the adoption of new technology and generate more uniform results between centres. Therefore for India also we should have test only centres and separate dedicated repair centres. These vehicle inspection centres can be run by private sector. It is advisable to have a number of dedicated vehicle inspection centres spread uniformly across the city.
- The I&M program should be made mandatory as experience have shown that voluntary program are not successful, if the owners have to pay a fee.
- I&M should be framed within a national regulatory framework with its implementation being done by the state government or the local government involved.
- The Government should act as a regulator and actual implementation should be done by the private sector. Various options could be explored for enabling and encouraging private sector participation
- The International experience suggests that the program should focus on both inspection and maintenance of inuse vehicles. The program should also focus on strengthening the service and repair industry. In India, it would be worthwhile, if the vehicle manufacturers can set up authorised repair centres. Both the Government and the vehicle inspection centres should have a list of these repair centres and type of repairs done by them.

Features for structuring the program

Experiences have shown that well designed but poorly enforced programs have not revealed effective results. The following are the essential features that should be present in any vehicle inspection and maintenance program

- A well designed mechanism for technical and administrative audit of performance of centres is very essential.
- Calibration audits of the equipment by independent accredited materials standard laboratory.
- Duties of regulatory agency should be well designed
- Road side testing with help of mobile squads

Institutional structure

- The Central Government should frame a regulatory structure specifying lists of tests to be conducted, items to be inspected, frequency for conducting these tests and vehicle inspection fees, defining criteria for selection of private sector for setting up a vehicle inspection centre.
- The State Government should identify the number and location of these centres, identify the private sector to be involved, audit the performance of centres, and on road enforcement.
- The co-ordination between the various departments at State level and between Central and State government should be there. The roles and responsibilities should be clearly defined. Efforts should be made to reduce the no of agencies both in implementation and policymaking stage.
- The program should be linked to registration/ insurance of vehicles to make it more effective and in making it mandatory. No vehicle would be issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.

Test Procedures for emission checking

Vehicle emissions consist of tail-pipe emissions (CO, HC, NOx, CO2 and particulate matter), evaporative emissions and crankcase emissions. Emissions of new vehicles are controlled using type approval and conformity of production (COP) technique in India. However, the same measurement methodology cannot be directly applied to the in-use vehicle testing because of the cost factor and technical complications. Simple test methods and corresponding standards are necessary for effective implementation of I&M emission programmes. There is a variety of emission test procedures followed for in-use vehicle emission control Worldwide. The tests mentioned below give an overview of the different test methods followed, test instrumentation and their advantages & disadvantages are discussed in detail in the Annexe D. The overview is covered under three sub-sections as below:

1. The I&M test procedure for emission checking worldwide, which includes :
   - Tailpipe emission measurement
   - Evaporative system effectiveness
2. Role of Remote Sensing in I&M
3. On-board diagnostic system check as a part of vehicle I&M programme

Test Procedures for safety checking

The items for inspection under safety is more or less similar in most of the countries and most of these items are based on visual inspection only. Some of items inspected are:

- Lighting equipment
- Tyres and road wheels
- Seatbelts
- Horn
- Side mirrors
- Registration plates

The details of how these items are inspected are given in Annex E and details of equipment and instrumentation used are given in Annex G.

Cost of Inspection tests

In Japan a computerised motor-cycle inspection system inclusive of a brake tester, speed tester, sound level tester, automatic head light tester, gas analyzer and alignment tester along with process indicator and control computer etc would cost approximately JY 24,110,000. A Computerised vehicle inspection system up to 3 T/10 T/ 13 T inclusive of side-slip tester, brake tester, speed tester sound level tester, automatic head light tester, alignment tester along with process indicator and control computer etc, gas analyzer and opacity meter would cost approximately JY 38,850,000.

The cost of conducting some of loaded tests (transient or steady state) are given in table 2.3.

Table 2.3: Capital costs of loaded tests

Test Type	Capital cost
IM240	$ 75,000-$125,000
ASM 2	$40,000
Mass 31	$43.000

Training and Capacity building

International experience suggests that training and capacity building program would have to be organised focussing on the following target groups

- Staff, attendants and Motor Vehicle Inspector at the vehicle inspection centres.
- Auditors for auditing performance of inspection centres and staff of state government and the mobile squad for on road enforcement.
- Training should also be imparted to the mechanics in the vehicle repair centres so that they can repair the vehicles efficiently.

Data management

The Decentralised vehicle inspection centres can link up online to a centralised computer centre, where all the data from these centres can be transferred so as to build up a database on inspection and maintenance of inuse vehicles in a city. This network could also be used to transfer data and information like a vehicle inspection report from a private owned vehicle inspection centre to a Government owned vehicle certification centre to issue the certificate.

Public participation

- Awareness campaign to educate people, consumer groups and NGOs about benefits and advantages of the program.
- Information about procedure of inspection, time and fees involved in inspection of vehicles. Location and timings of the vehicle inspection centres
- List of authorised vehicle repair centres should be available to the vehicle owners.
- Some mechanisms or incentives for encouraging people to come for vehicle inspection like free service coupons.

The Government as a regulator should have a public complaint centre to register and take prompt action against complaints related to malpractice's in vehicle inspection centres or repair centres, identifying polluting vehicles.

Benefits of the vehicle inspection program

A properly regulated and enforced vehicle inspection and maintenance program could lead to following benefits:

1. Prevention of air pollution: Results and studies have shown that by proper inspection and subsequent maintenance of vehicle leads to around 20-27% reduction in the mount of CO and HC released from the vehicles.

2. Reduce Fuel consumption: An effective I&M program could lead to 24% reduction in the fuel consumption
3. Safety of inuse vehicles: Studies have shown that in countries where I&M program was implemented successfully, around 30% reduction in number of accidents has been reported; where proper maintenance of vehicles has been highlighted as a major contributor.

There are other benefits of an I&M program. These are:

1. Reduce repair costs. Discovering a worn component before it creates major problems can save big money.
2. Improved trade-in/resale value. A well maintained vehicle could be worth 2-3 times as much as one that's been neglected.
3. Better handling. Incorrect wheel alignment, worn suspension components and/or tires cause poor ride and handling.
4. Dependability. A well-maintained vehicle is less likely to stall, fail to start or otherwise leave you stranded.
5. Driving enjoyment. It's more comfortable and more fun to drive a car that holds the road and rides well.

3

Status of inspection and certification system in Indian cities

Introduction

Inspection and certification of inuse vehicles is the responsibility of the State Transport Department, which follow the rules and guidelines framed by the Central Government. To ease implementation of this responsibility the State Transport Department has developed regional transport offices that perform many other functions of the state department apart from inspection and certification of inuse vehicles. The existing situation and status of inspection and certification centres in India have been reviewed for Delhi and Maharashtra.

Delhi

Background

In metropolitan cities like Delhi, a large percentage of the vehicles are old vehicles, and do not meet the present stringent emission norms. There are almost 3 million vehicles currently in use in Delhi and the emissions from these also need to be controlled. Delhi has recorded the largest registration of motor vehicles even though it ranks third in the list of mega cities of the country, after Mumbai and Calcutta. Since 1971, the growth of registered motor vehicles in Delhi has followed an exponential path .As on 31 December 1998, total vehicles registered in the city was nearly 3.17 million.

Institutional set up

As per Sec.56 of the Motor Vehicles Act, 1988 every transport vehicle is required to possess a certificate of fitness, which is granted by the authorised registering authority or the authorised testing station. So far the power to issue fitness certificate has not been given to any private agency. In Delhi, the Transport Commissioner is incharge administering the Motor vehicles Act, 1988 in the State Government. The Transport Commissioner is of the rank of Commissioner of Police under the MV act, 1988. There are two Joint Director(s) (Technical) and (enforcement), which are responsible for Inspection of MV under the act; Deputy Director(s) (transport) assists them. For the purpose of enforcement and checking the staff shall be under the Commissioner and exercise powers of the corresponding rank of Delhi Police. The rank of Deputy Director is incharge of the Vehicle Inspection Centre in Delhi.

It is however pointed out that the requirement of a fitness certificate is mandatory only for the transport vehicles, which constitute only about 20-30 percent of the total vehicular population.

Regulatory framework

The Delhi Motor Vehicle Rules, 1993 govern the transport sector in Delhi. The prescribed authority (board of inspection) shall conduct the testing and inspection of vehicles according to methods prescribed by the Transport Commissioner, Delhi. These tests should be done in accordance with guidelines set in the Motor Vehicle Act, 1988 and Central Motor Vehicle Rules, 1989.

Vehicle Inspection centre

The Delhi Government Transport Department has established a single vehicle inspection centre at burari for commercial vehicles. The details of the centre based on the information from the motor vehicle inspection centre are discussed in the following sections.

General information

1. Name of the Centre
   Vehicle Inspection Unit, Burari.
2. Approximate area of the centre.
   25 Acres out of 42 acres initially allotted.

Inspection centre Details

Tests conducted for private/ commercial vehicles

- Safety – Tests related to mechanical, body, suspension and controls. No tests for private vehicles.
- Environment – Pollution level is checked by the authorised PUC test centres all over Delhi as per Delhi Motor Vehicles Rules, 1993.

Parameters for conducting these tests

As defined under C.M.V.R., 1989 i.e. rule 62 of C.M.V.R. (Annexe B)

Frequency of conducting these tests

As defined in section 56 of motor vehicle, Act and rule 62 of C.M.V.R., 1989- i.e. initially for 2 years and for one year thereafter till its life tenure

Fees for conducting these tests

As per rule 881 of CMVR, 1989 (amended in 2001), the inspection fee is given in Table 3.1.

Table 3.1 Vehicle inspection fees

Vehicle category	Testing Fee		Certification fee		Inspection fee
H.G.V	400	+	100	=	500
H.M.V	400	+	100	=	500
M.G.V	300	+	100	=	400
M.M.V	300	+	100	=	400
L.G.V	200	+	100	=	300
L.M.V	200	+	100	=	300
Autorickshaw	100	+	100	=	200

Criteria for granting fitness certificate

As per rule 62 of extended C.M.V.R, 1989 (amended in 2001) (Annexe B)

Documentation

The documents that are verified before accepting the vehicle for fitness check are:

1. Registration Certificate
2. Permit
3. Updated date road tax clearance report
4. Valid pollution under control certificate.
5. Old fitness certificate
6. Fee receipts

Testing capacity of the centre

On the basis of data collected from last seven months, the figures for number of vehicles, heavy/ medium/ light, reporting at the centre on a daily are as under: -

Table 3.2 Number of vehicles reporting

Category	Vehicle inspected per month
HMV/HGV	@ 1704 per month
LMV/LGV	@ 3745 per month
MGV/MMV	@ 2 per month
Taxi	@ 146 per month
Auto Rickshaw	@ 3928 per month
Total	@ 9525 per month

All vehicles which are produced before inspectors daily are inspected on the same day. The average taken from computerised record from past few months for the number of vehicles inspected daily is as follows;

Table 3.3 Vehicles inspected daily

Category	No. of vehicles
HGV/HMV	50 to 60
MGV/MMV	1
LGV/LMV	150 to 160
Taxi	6 to 10
Autorickshaw	160 to 170

On an average 5 to 10 minutes are spent on inspection of each vehicle, if done physically/manually and nearly 90% of vehicles are found fit

Vehicles found unfit

A lot of common deficiencies observed. These are related to exhaust emission, engine, transmission, steering, suspension, lights, colour, controls etc. The vehicles found unfit are issued defect report which is valid for 60 days within which owner has to get them rectified and reproduce the vehicle for inspection again. If found fit, then fitness certificate is issued.

Infrastructure

There are 10 Test Bays/Test Tracks in the centre

List of equipment's available with test centre

1. Automatic vehicle testing machine
2. Brake analyser
3. Head lamp aligner

Type of equipment

i) Automatic 01+08=09
ii) Semi automatic
iii) Manual

This equipment's are maintained and can be calibrated through annual maintenance contracts. (Not given to anyone at present due to financial restraints)

Human resources

Designation & Qualifications of Head of the Centre

Presently Deputy Director – not prescribed, although no post of Dy. Dir. Sanctioned to this unit.

Number of employees

(i) Technical - 12
(ii) Non-technical – 08
(iii) Data Entry Operators – 02

What are the minimum qualifications

Diploma/degree in mechanical or automobile engineering holding a HMV licence for a period of 5 years or above. They are not given regular training (expect to last batch of MVIs for 4 weeks).

Working hours

From 8:30 a.m. to 4:00 p.m. daily.

Observations and comments

Manpower and budgetary constraints

As per study made by Administrative Reforms Department the inspection unit is not properly staffed. As decided by the Planning Department, the budgetary allocations are not sufficient.

Procedure followed for granting a fitness certificate

The procedure followed for granting fitness certificate at vehicle inspection centre is described below:

The owner or his authorised representatives wanting to have grant/renewal against any vehicle, is required to produce the vehicle before MVI at Burari along with relevant documents, updated road tax clearance report and to deposit the inspection fee as prescribed under rule 81 of CMVR, 1989. Thereafter vehicle is to be produced before MVI in the designated inspection bay for the day. Then, mechanical, electrical, cabin, body and other physically inspection is done against every vehicle rechecked and relevant documents are rechecked. If found fit/within prescribed limit, fitness certificate in form 38 is issued after feeding every data in computer. Two inspectors under board of inspection sign this certificate and in case it is not found fit, a defect report is issued against the same to bring the vehicle for re-inspection within two month's after proper repairs. The owner is required to bring the same vehicle for fitness and is now required to pay Rs. 20/- as defect clearance fee. At this time, all the defects mentioned in the earlier report are checked along with other important parameters and documents and if cleared, a new certificate of fitness is issued for one year from the date of issue.

Based on our physical inspection of the centre it was found that there are no equipment's functioning and inspection is done based on visual inspection only.

Enforcement mechanism

As per the Delhi Motor Vehicle Rules, 1993, any officer as appointed by the Transport Commissioner can inspect the working of the authorised PUC centre and the Commissioner can cancel the license if the centre is not found working properly. The Transport Department officials authorised by the Commissioner have powers to conduct on road checks for goods vehicles for possession of a valid inspection certificate. The Delhi Police officials of the rank of sub inspector and above can also inspect a commercial vehicle. But the implementation of this measure is very weak and there are no well-trained mobile units for this purpose.

Maharashtra

Background

Motor Vehicle population in Maharashtra as on 31st March 2000 is 61,23,883 out of which two wheelers constitute 40,49,152 (61%) ,goods carriage constitute 5,37,728 (8%), buses constitute 47,766 (0.7%) ,taxis constitute 84,429 (1.5%) ,and autorikshaws constitutes 3,88,709. (4.9%) of the total vehicles on road. Motor Vehicles are constantly checked by the Department for ensuring compliance with the provisions laid down for pollution. Total Private Pollution

Under Control Checking Centres in the city of Mumbai 422 and 680 Pollution Under Control Checking Centres in the State (other than Mumbai) have been authorised by the Department to issue Pollution Under Control Certificate.

Institutional structure

The Motor Vehicles Department has been established under section 213 (1) of the Motor Vehicles Act, 1988. Motor Vehicles Department is mainly responsible for enforcing various provisions of this Act. The Transport Commissioner heads Motor Vehicles Department.

The main functions of the Motor Vehicles Department are:

1. Enforce the provisions of the Motor Vehicles Act, 1988, the Central Motor Vehicles Rules, 1989 and the Maharashtra Motor Vehicles Rules, 1989.
2. Ensure a co-ordinated development of Road Transport through the regime of permit.
3. Levy and collection of tax on Motor Vehicles under the Bombay Motor Vehicles (Transportation of Passengers) Act, 1958.

A number of activities are performed by the Motor Vehicles Department while carrying-out the above-mentioned functions, which include granting certificate of fitness to transport vehicles.

The office of the Transport Commissioner is located at Mumbai. The State has been divided into 10 Regions and a Regional Transport Officer heads each region. There are 3 Regions in the city of Mumbai. The offices in Mumbai are located at Tardeo (i.e. Regional Transport Office, Mumbai (Central), Andheri (i.e. Regional Transport Office, Mumbai (West) and Worli (i.e. Regional Transport Office (East). The other Regional Transport offices are located at Thane, Pune, Aurangabad, Amravati, Nasik, Nagpur and Kolhapur. Mumbai (East) RTO has the maximum number of vehicles on road followed by Pune, Nahshik and Thane.

Offices have also been established at the District Levels in addition to the above offices at the Regional levels. Each District in Maharashtra has an independent office of the Motor Vehicles Department. The offices in Taluka places at Shrirampur, Kalyan and Pimpri-Chinchwad have been established taking into consideration the vehicle population at these places. The Deputy Regional Transport Officer heads all the District Offices. There are 25 Offices of the Deputy Regional Transport Officers.

There are 8 Regional Transport Authorities and 1 State Transport Authority established in the State of Maharashtra. These Authorities are primarily concerned with keeping a control on transport vehicles by granting them permits. Transport Commissioner is a member of the State Transport Authority and Joint Transport Commissioner functions as Secretary of the State Transport Authority, similarly the Regional Transport Authorities. The Secretary of the Authority is responsible for giving effect to the decisions taken by the authority.

The staff functioning in Motor Vehicles Department can be classified into 2 categories i.e. the Executive Officers like Asst. Inspector of Motor Vehicles, Inspector of Motor Vehicles, Assistant Regional Transport Officer, Deputy Regional Transport Officer, Regional Transport Officer and other officers of the Transport Commissioner's Office who are concerned with enforcing the provisions of the motor vehicles Act and the Tax Act.

In order to bring uniformity and proper co-ordination in the working of the Department a lot of stress is being laid on modernisation through on-line computerisation of various activities in the department. Presently the on-line computerisation is interned Regional Transport Officer with Pune, Thane, Nasik Kolhapur, Amravati, Nagpur and Aurangabad. The work of issue of Registration Certificate, Taxation Certificate, MDL, LLR, Fitness and activities relating to permit has been computerised. Remaining activities in these offices will also be seen computerised.

However, the work in the offices in Mumbai has not been made on-line due to some difficulties. Instead the important activity of maintaining records of inspection of transport record are being taken on priority in the offices in Mumbai.

The other offices will also soon be connected by nicknet connects the Transport Commissioners Office to Regional Transport Offices at Pune, Nasik, Kolhapur Thane, Aurangabad, Amravati and Nagpur.

Regulatory framework

The relevant Acts / Rules and Section of these Acts (State Acts) governing I & M of inuse vehicles in the State of Maharashtra –

a) Motor Vehicles Act, 1988
b) Central Motor Vehicles Rules, 1989
c) Maharashtra Motor Vehicles Rules, 1989

Enforcement mechanism

There are 36 Flying Squads in the State of Maharashtra, which are responsible for enforcing various provisions of the Motor Vehicles Act and Tax Act. The Flying Squads have recovered 26.52 crores of revenue as tax and penalty during the year 1999-2000. Motor Vehicles Department established under Section 213 of Motor Vehicles Act, 1988. The private sector has no responsibilities and functions in I & M of inuse private and commercial vehicles in the State of Maharashtra at present. Hence the State Government shoulders the responsibilities and perform the functions under the M.V. Act and Rules made thereunder in I & M of in-use private and commercial vehicles i.e. the Motor Vehicles Department (the Transport Department) carries into effect the responsibilities and functions provided under the above mentioned laws.

There are enforcement squads and Border Check Posts under the M.V. Department of Maharashtra.

As the inspection is carried out by the Government Department itself there is no arrangement for auditing the quality of inspection except that the re-inspection may be carried out by the higher authorities to the inspecting authority i.e. Inspector of Motor Vehicles Act, 1988. The fine / punishment if a vehicle is found not possessing a valid fitness certificate is as per the Section 192 of Motor Vehicles Act, 1988.

Vehicle inspection centres

The Regional Transport Offices, the Dy. Regional Transport Offices of the Motor Vehicles Department act as the inspection centres.

Most of the offices mentioned above are located at the district places. The details of the vehicle inspection centre as reported by the Transport Commissioner, Maharashtra office are discussed in the following section

Inspection centre Details

1. Tests conducted for private / commercial vehicles.

(a) Safety – Mostly tests are conducted to verify the compliance of Section 109, 110, 111 of M.V. Act, 1988 and C.M.V.Rules, 91 to 137 and Maharashtra Motor Vehicle Rules 159 to 221 as applicable to the vehicle inspected

(b) Environment – Mostly Pollution under Control Certificates are verified. If there is any reason to believe that a motor vehicle is not complying with the provisions of sub rule (2) or sub rule (7) of Rule 115, re-test for smoke emission is carried out at the offices where test facility is available or at one of the test centres approved by the Government (Note: - There are PUC Centres owned by private owners in the State which help a lot in protecting environment. However some cases of mal-practices have also been detected).

Frequency of conducting these tests

These tests are conducted at the time of new registration and then after at the time of renewal of fitness certificates for transport vehicles and renewal of certificate of registration in case of non-transport vehicles as provided in the M.V. Act & Rules made thereunder.

Fees for conducting these tests

The fees for conducting these tests are as prescribed under the M.V. Act & Rules made thereunder.

Criteria for granting fitness certificate

The criteria for granting Fitness Certificate – are as per the provision of M.V. Act & Rules made thereunder mentioned earlier.

Documentation

Payment of receipts of necessary fees, the Registration Certificate, Tax Certificate, Insurance Certificate, Pollution Under Control Certificate for all vehicles and Certificate of Fitness and permit in case of transport vehicles are verified before accepting the vehicle for fitness check in case of vehicles already registered and payment of necessary fee, Insurance Certificate and other documents as prescribed under C.M.V. Rule 47 are verified.

Testing capacity of the centre

Almost all the vehicles reporting at various offices are accepted for inspection irrespective of the number of vehicles reporting and the figures are different for different offices according to the vehicle population under the jurisdiction of that office. The average time spent on inspection of each vehicle varies from office to office depending on the vehicle population under the jurisdiction of the office and number of inspecting officers available in the office. It may come between 10 to 20 minutes per vehicle irrespective of the category of the Motor Vehicle. Nearly 90 % of vehicles are found fit.

Common deficiencies observed and repair procedure

1) Excessive play in steering connections.
2) Springs require tension (Camber – R/A)
3) Lamps – R/A
4) Silencer – leakage

5) Clutch – R/A
6) Tyres – R/A, cuts, plain (worn-out)
7) Paint work – R/A
8) Upholstery – R/A
9) Brake – R/A
10) Windshield Wiper – u/s
11) Hand Brake – u/s
12) Rear view mirror not provided / broken
13) Reflectors – not fitted,
14) Body – R/A
(Note R/A = Requires Attention, u/s = unserviceable)

Prescribed under Maharasthtra M.V. Rule 45 (11) and the M.V. is refused for renewal of certificate of fitness / registration. The owner / driver rectifies the defects and then on rectification the M.V. is reproduced for inspection.

Infrastructure

Most of the offices are lacking the facility of Test bays / Test tracks and has only visual inspection.

Human Resources

Designation & Qualification of Head of the Centre

- Regional Transport Officers.
- Dy. Regional Transport Officers.
- Inspector of Motor Vehicles.

All are qualified in Automobiles i.e. DME or DAE or having qualification prescribed / declared equivalent to it by the State Government.
As such there is no facility available with the Government to give them regular training. However occasional arrangements are made to impart training to them in small groups. The working hours are between 10.00 hrs. to 1745 hrs. in most of the offices.

Conclusions

It is evident from earlier discussions that the present institutional structure of state level agencies for granting a vehicle fitness certificate is weak and need is there to strengthen it. The reasons for failure of the existing inspection procedure could be summarised as:

- At present, there is only visual inspection carried out by the inspectors, that is mandatory for commercial vehicles only. The inspectors and other personnel's are not given regular training for skill upgradation. There is not set procedure for inspection and more often, whether a vehicle is fit is left to the discretion of the vehicle inspector.
- The vehicle inspection centres do not have any instrumentation or equipment to carry out proper inspection of the vehicle
- The number of vehicles per inspection centre s very high, due to centralised nature of inspection further putting pressure on the limited capacity of these inspection centres.
- There is no mechanism present for monitoring/ auditing performance and capability of these centres.
- The mechanism for on road enforcement is weak and thus there is a need to institutionalise an effective inspection and maintenance program for inuse vehicles.

4

Action Plan

In the previous chapters a detail review of the existing Inspection and Certification system in Indian cities has been done, where problems in the existing institutional and regulatory structure, procedure for granting an inspection certificate, etc. have been highlighted. The status of the inspection centres in few Indian cities have been reviewed. The study has concluded that the existing I&M regime in India is weak and would need to be strengthened in a number of areas to reduce emissions from in use vehicles and increase safety of the vehicle. The international experience in successfully implementing the inspection and maintenance has been reviewed and based on experiences of other countries, lessons have been drawn for improving the existing system in India.

Proposed action plan

India would have to strengthen its existing inspection and certification system for improving roadworthiness of inuse vehicles in India. This would involve;

- Creating a legislative framework for implementing a comprehensive I&M program
- Strengthening the existing institutional arrangement
- Introducing stringent emission norms for inuse vehicles
- Establishing well equipped and certified vehicle inspection centres
- Recommending list of items to be inspected and test procedures for testing vehicles on emission and safety parameters
- Introducing well equipped vehicle repair and maintenance centres

An Action Plan has been prepared for improving the I&M program in India, which is discussed in the following sections of this chapter.

Amendments in Acts

- At present only transport vehicles are required to undergo annual fitness checks. It is therefore imperative that **Section 56 (1) of the Motor Vehicles Act, 1988** should be amended to provide for fitness testing for all categories of vehicles at prescribed periodicity.

- To enable State Governments adopt all the amendments proposed in the Central Motor Vehicles Rules, 1989 and Motor Vehicles Act, 1988 the Central Government would first have to make the necessary amendments in **Section 56 (1) of Motor Vehicles Act 1988**. This would make it mandatory for the State Governments to adopt and make necessary changes in their respective State Motor Vehicle Rules.
- Another important change in the law could be **under Section 213 of the Motor Vehicle Act, 1988**. Under this section, a provision may be made authorising the State Governments to constitute a panel of auditors for the purpose of conducting audits of the private inspection centres. Powers should also be given to the auditors to impose fine on non-performing inspection centres.
- At present validity period for a fitness certificate for a Transport vehicle is stipulated under **Rule 62 of the Central Motor vehicle Rules, 1989**. It is proposed to amend the Rule 62 to prescribe validity period of the fitness certificate both for transport and non-transport vehicles as per the inspection schedule given in Table 4.4.
- Since the system of fitness certificate for transport vehicles is in place for a very long time and is also inter-linked with renewal of permits, no defaulters have been reported in obtaining fitness certificates. In many states, a system of "one-time tax for life" has been introduced in respect of non-transport personalised vehicles and therefore the private vehicle owners do not come to RTO office for paying road tax. This will also be a limiting factor for implementing the I&M system in respect of non-transport vehicles. Therefore, to overcome this difficulty, the concept of "one time tax for life" should be modified and this tax should be payable after a certain time period, synchronising with the period of validity of fitness certificate. Payment of tax and renewal of registration certificate should be linked up so that both these requirements are fulfilled at the same time. **The State Motor Vehicle Taxation Rules** would have to be amended to include these provisions. No tax should be accepted unless a fitness certificate is obtained from an authorised testing station. Non-payment of tax within the prescribed period should be made an offence with severe punishment, including the provision for impounding of vehicle.
- The details of parameters to be checked at the time of fitness check are given in **Rule 62 of the Central Motor Vehicles Rule, 1989**. This list also needs to be modified to include more items both on safety and environment parameters requiring regular checks as specified in Annexe F.

- A Code of practice needs to be prescribed for regulation and control of authorised vehicle testing station under **Rule 63 of the Central Motor Vehicles Rule, 1989.** This code of practice could be formulated based on the model code of practice as suggested in the Annex H.

Strengthening existing Institutional structure

The Central Government and the State Government play a very important role in implementing and enforcing the I&M program in India.

Central Government

The Central Government (Ministry of Road Transport and Highways) would be responsible for creating a legislative framework for effectively introducing the I&M regime in India by suggesting relevant amendments in Motor Vehicles Act, 1988 and Central Motor Vehicle Rules, 1989. The Ministry of Road Transport and Highways would have to develop an inspection and certification program, which includes responsibilities like developing testing manuals, developing code of practice, training modules etc and fix emission norms for inuse vehicles. The Government should also look into the option of establishing a separate directorate for vehicle inspection on lines of Directorate of Vehicle inspectorate, UK. This inspectorate could function as an executive agency for the Ministry of Road Transport and Highways for overseeing the implementation of the proposed inspection and maintenance program by the State Government. The Central Government would be responsible for co-ordinating the I&M programme. The Central Government needs to identify a nodal agency for emission inventory, regularly monitoring air quality and develop some models to estimate contribution of vehicular air pollution to the total ambient air quality.

State Government

The State Government would be responsible for making all the relevant changes in the State Motor Vehicle Rules and State Motor Vehicle Taxation Rules incorporating the proposed amendments in the Motor Vehicle Act , 1988 and Central Motor Vehicle Rules, 1989. The Government should act as a regulator and inspection centres should be run by the private sector.

The State Transport Department would be responsible for approving the vehicle inspection centres, auditing the performance of centres and enforcement on road. Regular training and capacity building programs would have to be organised for the employees of the state transport department to effectively perform their roles and responsibilities. The program should be linked to registration/ insurance of vehicles to make it more effective and in making it mandatory. No vehicle should be issued a registration or a re-registration certificate unless it possesses a valid vehicle inspection certificate.

Auditing vehicle inspection centres

I&M programmes are often being associated with fraud and corruption. Failure to address these issues will seriously or even totally compromise the effectiveness of I&M system. A well functioning audit and quality assurance system is crucial for acceptance and success of any I&M system. The State Transport Department would have to set up a team of qualified personnel's to audit the performance of these centres. It should be done once in six months. The team should comprise of vehicle inspectors from Transport Department, representative from vehicle inspection centre, an independent auditor appointed by the State Government (preferably an automobile/ mechanical engineer from a reputed research or training institute) with relative good experience in the field. The team would check for:

- Proper presence of necessary equipment and other infrastructure in working conditions
- Proper inspection procedure being followed by the centre as detailed out in the manual
- Presence of qualified/ trained manpower in the inspection centre.

In India we have number of technical experts who could be used for auditing purposes. The system can be introduced that these auditors keep updating themselves every two years through the refresher courses. These programmes can be run by research institutes like ARAI, CRRI, IIP Dehradun and VRDE Ahmednagar. The State Governments can pay for the fees for training programme, which can be recovered from the vehicle inspection centre in form of fees/ taxes.

The State Transport Department can prepare a roaster of auditors based on their authorisation certificate and their performance in carrying out the audits. They can design audit plan for all the fitness centres under their jurisdiction. The fitness centres will pay for the cost of the audit. The transport authorities will re-validate the license for the fitness checks based on these audit reports. The audit should cover authenticity of the certificates given, storage, extraction, traceability and security of the data, operator's validity in terms of training, parking area and security of the vehicles etc. This well qualified team of auditors would make random checks in inspection centres to check for proper functioning and operation of the inspection centres.

A penalty system should be imposed for auditing the performance of the service centres based on the UK model, where for every different type of offence committed certain penalty points are awarded and after a centre accumulates certain number of penalty points its license is cancelled thus enabling a more transparent form of working of the inspection centre and auditing process. This could include offences like:

- Fraud/ duplicate issue of the fitness certificate
- Improper inspection procedure followed for inspection of vehicles
- Presence of inadequate infrastructure, equipment in the vehicles inspection centre
- Lack of well trained and qualified staff

Enforcement on road

Although, Traffic Police would be responsible for checking vehicles for possession of a valid fitness certificate, but in addition mobile checking vans would have to be set up for random checking of vehicles on road. These mobile units would have minimum equipment for checking roadworthiness of vehicle on the road and would have well qualified vehicle inspectors from the Transport Department. Those vehicles found possessing a fitness certificate but still not up to the prescribed standards would be sent to the vehicle inspection centre for detailed re-examination. These vehicles would go in a centre different from previous one and if not found fit would have to pay the fee and go to repair centre for further repairs before getting a valid inspection certificate.

There are other reasons to use Mobile Test Stations; for example part-time use in case of breakdown or renovation of existing fixed test stations, road checks on vehicle safety. Another use of Mobile test stations can be in areas with lower vehicle density, which makes fixed test stations not economically feasible. To mandate some of the above proposed recommendations, some changes would have to be made in the relevant Act and Rules. These proposed amendments are given in the Table 4.1.

Table 4.1: Proposed Amendments

Act	Section no	Existing provision	Amendments proposed	Remarks
Motor vehicles Act, 1988	Section 56 (1)		The word "transport vehicle" should be substituted with the word "motor vehicle" wherever it occurs in this section	This amendment is necessary so a bring all categories of vehicles und regime. As per existing provisions, o transport vehicles are covered unde I&M programme. As per Section 2(the Act, no personal vehicle is trea transport vehicle.
	Section 192(1)	192: Using vehicles without registration : (I) Whoever drives a motor vehicle or causes or allows a motor vehicle to be used in contravention of the provisions of section 39 or section 56 shall be punishable for the first offence with a fine which may extend to five thousand rupees but shall not be less than two thousand rupees for a second or subsequent offence with imprisonment which may extend to one year or with fine which may extend to ten thousand rupees but shall not be less than five thousand rupees or with both.	Title of Section 192 should be modified and Sub-section (1) should be added 192: Using vehicles without registration and fitness certificate:(1) Whoever drives a motor vehicle or causes or allows a motor vehicle to be used in contravention of the provisions of section 39 or section 56 shall be punishable for the first offence with a fine which may extend to five thousand rupees but shall not be less than two thousand rupees for a second or subsequent offence with imprisonment which may extend to one year or with fine which may extend to ten thousand rupees but shall not be less than five thousand rupees or with both. It is clarified that even if the vehicle is validly registered, non-possession of a fitness certificate shall be punishable	It is proposed to impose heavy punishment so that motor vehicle ow are motivated to have the motor veh properly inspected and maintained the provisions of Motor Vehicle Act Rules

Act	Section no	Existing provision	Amendments proposed	Remarks
			with the above penalties in addition to cancellation of registration.	
	Section 213	Appointment of motor vehicle officers	A new section may be inserted after Section 213: Section 213 A: Inspection Auditors: The State Government shall by notification in the official gazette constitute for the State a Panel of experts in the field of road transport, for the purpose of carrying out audit of the authorised testing stations set up under section 56(2) . The State Government may make rules to regulate the constitution, functions , powers to impose penalties (specifying maximum limits) for malfunctioning, qualifications/tenure of the members and any other conditions of the Panel.	
Central motor vehicle Rules, 1989	Rules 62,63 and 65	Rule 62: Validity of fitness certificate Rule 63: Regulation and control of authorised testing stations Rule 65: General conditions to be observed by the holder of letter of authority	The words "transport vehicle" shall be substituted by the words "motor vehicle" wherever these occur Rule 62: The validity period of the fitness certificate for different category of vehicles is given in Table 4.12	This amendment is necessary to cover all the vehicles under inspection regime in line with amendment to section 56 of the Act. Further amendments to Rule 62 under which parameters for checking a vehicle are prescribed, can also be made as and when new parameters are identified.

Contents of an Inspection and Certification program

In-service vehicles have to be tested for both safety and emission parameters.

Safety checks

The commercial vehicles are required to undergo the fitness checks as per the gazette notification given in Annexe B. The proposed lists of tests to be done, methodology for inspection and reasons for failure have been detailed out for both commercial and private vehicle in the Annexe F.

It is recommended that there should be a mix of visual tests and automated inspections in beginning considering the high costs involved in setting up fully automated vehicle inspection centres. The vehicle inspection program should be introduced in India focusing on basic tests with combination of both visual and automated tests, trying to keep the vehicle inspection program as simple as possible.

The basic proposed list of items to be tested based on visual inspection are given in Table 4.2.

Table 4.2 List of automobile components to be tested based on visual inspection

	Visual inspection tests
1.	Steering
2.	Chassis or chassis frame
3.	Fuel tank and piping
4.	Exhaust pipe & Silencer
5.	Bumper bars
6.	Engine mountings
7.	Battery
8.	Security of body
9.	Seatbelts
10.	Condition of body
11.	Tipping gear
12.	Axles
13.	Stub axles, suspension joints, and wheel bearings
14.	Wheel allingment
15.	Road wheel hubs
16.	Tyres

The lists of items to be inspected through automated equipment's is given in Table 4.3

Table 4.3 List of automobile components to be tested through automated equipment's

Items to be tested	Tests	Equipment required
Service brakes		
Emergency brakes	Brake test	Brake-Speed combination Tester
Parking brakes		
Silencer	Noise test	Sound level tester
Headlight	Headlight test	Automatic Headlight Tester
Emissions	Free acceleration tests	Diesel
	Idle tests	Gasoline

Formulating stringent emission norms for inuse vehicles

At present, the emission testing is carried out at PUC centres. The current emission standards for in use vehicles are given in Table 4.3. More stringent emission norms would have to be set for newer category of in use vehicles (Euro II and beyond) and therefore standards could be different for old & new vehicles. Limits may be dependent on technology like 2/4 stroke, cat fit, electronic engine management etc. It is proposed to make these standards more stringent as per the proposed emission standards given in Table 4.4. These proposed emission standards are presently under discussion among the relevant Government agencies.

Table 4.4 Emission standards for inuse vehicles

Category of Vehicles	Type of engine	Current Standard		Proposed standard applicable for the vehicles manufactured on and after 1st April 2000	
		CO (%)	HC (C6) (ppm)	CO (%)	*HC (C6) (ppm)
Two/three wheelers operating on gasoline / CNG / LPG	Two stroke	4.5	-	3.5	7000
	Four stroke	4.5	-	2.5	1000
Four wheelers (cars, buses etc) operating on gasoline/ CNG/LPG	With catalytic converter	3.0	-	0.5	200
	Without catalytic converter	3.0	-	1.5	600

For all diesel engine vehicles (naturally aspirated as well as turbo-charged) free acceleration test has been suggested. The current standard as per Rule 115 of CMVR, 1989 is 2.45 m^{-1} or 65 HSU. (Hartidge smoke unit).

Emission checks

To confirm to the in use vehicle emission standards, the in-use vehicle emission control strategy can be considered in two phases. In phase I, it is proposed to have an idle test measuring CO, HC along with lambda, rpm.

In phase II, NOx measurement are proposed to be added along with other parameters. The proposed test in Phase II is a LOADED TEST (can be transient or steady state). This is being suggested as Phase II as some additional work and time would be required to come up with test methodology for carrying out loaded test. This test will measure the pollutants in terms of MASS & not concentration.

Phase – 1

As a short-term strategy the proposed vehicle inspection centres could do high idle & lambda/ air fuel ratio measurement tests. It is proposed to have 4-gas analyser for vehicle testing. This will have CO, HC, lambda & rpm measurement facility. This would be an improvement over the existing testing facility available with the PUC testing centre, which is a 2-gas analyser. The cost of a 4-gas analyser is almost twice as compared to the conventional 2-gas analyser. The proposed emission checking system would have following additional features.

- Intelligence to be built-in in the instrument so that when the prescribed calibration interval is over, the instrument cannot be used for testing.
- The meter with better accuracy is required for checking of catalytic converter fitted vehicles.
- Safety to be built-in in the instrument for other parameters like insufficient warm-up, low flow, leak in the analyzer, probe, hydrocarbon residual check etc.

Phase – 2

It is a well-established fact that the idle short tests do not represent the realistic emission performance of the vehicle. Therefore a loaded or a steady state test is being suggested to be introduced as phase II for emission checking in India. A number of test methodologies like IM 240, ASM test, OBD and Bar 31 are available as evident from the International literature review and detailed out in Annexe D. There is an need for prescribing an Indian test methodology for conducting loaded emission tests. Some additional work would have to be done before a particular loaded test methodology is adopted and customised to the driving cycle of Indian cities.

Inspection for CNG vehicles

This checklist is a guide for the installer when carrying out the inspection prior to installation certificate, which is being proposed by the expert committee to the Government to be included in the CMVR, 1989 as an amendment. This could also be used by the vehicle inspector examining CNG vehicles before giving a vehicle inspection certificate.

Safety Checklist for Installation
(Reference AIS 028)

1. Cylinder :
    - Approved by DOE
    - Validity of Certificate
    - Free from corrosion
    - Mounted securely and inside vehicle parameter
    - Mounting points free from corrosion and fractures
    - Shielded and valves protected where necessary
    - 5 mm clearance between cylinder to vehicle components provided
    - Ground clearance correct
2. Valves :
    - Cylinder valve operating correctly
    - Burst disc fitted
3. Filling connection :
    - Refuelling connection made external to vehicle interior
    - Captive dust plug fitted
    - Meets proof loading of 50 kgf
4. Refuelling interlock :
    - Operation correct.
5. Non-return valve
    - Operation correct free from bypass leakage
6. Leak test :
    - All valves and fittings leak free.
7. Vapour sealing:

- Gas tight

8. Ducting :
   - Free from damage and secure to outlets.

9. Pliable sub-compartment
   - Ease of operation of cylinder valve satisfactory.
   - Position identified

10. Fuel line:
    - Free from damage and corrosion

11. Joints and connections:
    - Leak free

12. CNG shut off valve/solenoid valve :
    - Mounting secure
    - Operation correct
    - Leak free

13. Service shut off valve :
    - Operation satisfactory
    - Mounted securely
    - Leak free
    - Identified and operation clearly marked

14. Regulator:
    - Mounting secure
    - No gas bypass after engine has stopped turning
    - Shielded where necessary
    - Leak free

15. Control equipment:
    - Approval type

16. Gas air mixer:
    - Securely mounted
    - Backfire deflector where applicable

17. Bi-fuel shut-off device :
    - Operation correct
    - Petrol lock of where fitted is mounted securely
    - Petrol hose secure joints leak free and free from cracks
    - Sufficient flexibility for engine movement
    - Bypass device fitted where applicable

18. Electrical wiring :
    - Current limiting device fitted
    - Connections secure
    - Terminals insulated to prevent shorting
    - Wiring taped and clipped securely

19. Compliance plate :
    - Installed and carries correct markings

20. Identification labels :
    - Located front and rear of vehicle

It is mandatory to certify the CNG fitted vehicle regularly based on the checklist given above by the authorized installer . A copy of the installation certificate has to be sent to respective RTO office & kit certifying agency. It is necessary to get cylinder certified every five years (under explosive testing department).

Setting up vehicle inspection centres

After developing the contents of an inspection and certification program, vehicle inspection centres with 'test only' facilities would have to be set up. These centres would be authorised to inspect a particular category or categories of vehicle. This is essential due to different type of equipment, infrastructure and skill required.

Financial costs of a model vehicle inspection centre

Cost of equipment

The cost of basic equipment required for setting up a vehicle inspection centre is given in Table 4.5 to Table 4.8 dedicated for inspecting following category of vehicles

- 2 wheelers/ 3 Wheelers

- 3 ton vehicle (light cars/Vans etc.)
- 3 to 10 ton vehicle (Light and medium duty vehicles)
- 10 to 13 ton vehicle (Heavy duty vehicles)

Table 4.5 Cost of equipment for a 2-/3 wheeler inspection center

Name of test	Equipment required	Cost of equipment (Rs.)
Brake test	Brake-Speed combination Tester	3,000,000
Headlight test	Automatic Headlight Tester	1,500,000
Emission test	Gasoline (4-gas analyzer)	400000
Total cost		4,900,000

Table 4.6 Cost of equipment for a less than 3 ton vehicle inspection centre

Name of test	Equipment required	Cost of equipment (Rs.)
Brake test	Brake-Speed combination Tester	1,600,000
Headlight test	Automatic Headlight Tester	3,500,000
Emission test	Diesel (Opacity meter)	500000
	Gasoline (4-gas analyzer)	400000
Total cost		6,000,000

Table 4.7 Cost of equipment for a 3-10 ton vehicle inspection centre

Name of test	Equipment required	Cost of equipment (Rs.)
Brake test	Brake-Speed combination Tester	1,700,000
Headlight test	Automatic Headlight Tester	1,200,000
Emission test	Diesel (Opacity meter)	500000
Total cost		3,400,000

Table 4.8 Cost of equipment for a more than13 ton vehicle inspection centre

Name of test	Equipment required	Cost of equipment (Rs.)
Brake test	Brake-Speed combination Tester	2,100,000
Headlight test	Automatic Headlight Tester	1,200,000
Emission test	Diesel (Opacity meter)	500000
Total cost		3,800,000

Total cost of vehicle inspection centre

In addition to the equipment cost, there is a substantial component of land and building cost. The cost of the inspection centre would vary from city to city depending on its location. Therefore, an attempt has been made to quantify the inspection centre costs for cities of Delhi and Mumbai. To give a variation in the cities also, a high and a low cost range (representing land and building costs in various locations of a city) has been assumed based on estimates given by the real estate firms. The total cost estimates for setting up inspection centres in Delhi and Mumbai are given in the Table 4.9.

Table 4.9 Total cost of a vehicle inspection centre

	Delhi		Mumbai	
	Low cost estimates	High cost estimates	Low cost estimates	High cost estimates
		(In Million Rs)		
2 Wheeler/ 3 wheeler	8.2	10.0	8.8	10.6
Less than 3 Tonne vehicle	9.0	10.7	9.5	11.3
Between 10 Tonne - 13 Tonne vehicle	7.1	8.9	7.7	9.5
More than 13 Tonne vehicle	7.4	9.2	8.03	9.8

It is worth mentioning here that the total cost calculated is an indicative figure as it includes the land and building cost, which is approximately 20-25% of the total cost. Therefore since the land and building cost varies from city to city and within the city also, an accurate estimation of the cost of establishing an inspection centre is not possible. A city depending on its vehicle fleet composition, might decide to have inspection centres that offer combined testing facilities to various types of vehicles together.

Capacity of an inspection centre

The average capacity of the centre has been worked out assuming how much time it would take to inspect a car. The actual figures might be different depending on factors like type of vehicle, skilled manpower available infrastructure available, layout of the centre etc.

The number of total vehicles that a centre can inspect in a year has been estimated for a two-lane centre. The capacity has been worked assuming that it would take 20 -30 minutes to inspect a vehicle and that a centre would work for 8 hours a day for 6 days in a week. The capacity of an inspection centre for different types of vehicle is given in Table 4.10

Table 4.10 Capacity of a vehicle inspection centre

	Capacity of center (Vehicles/ year)
2 Wheeler	26000
3 Tonne vehicle	21000
10 Tonne vehicle	17000
13 Tonne vehicle	14000

Inspection fees

An inspection fee has been estimated for different category of vehicles. This has been worked out based on the total cost of an inspection centre and the vehicle handling capacity of an inspection centre. The inspection fees estimated for different types of vehicle are given in Table 4.11.

Table 4.11 Estimated vehicle inspection fees

Category of vehicle	Estimated Inspection fees	Existing inspection fee
	(Indian Rupees)	
2 Wheeler/ 3 wheeler	485	300
Less than 3 Tonne vehicle	520	300
Between 10 Tonne -13 Tonne vehicle	540	400
More than13 Tonne vehicle	650	500

Private sector participation

As evident from the above discussion huge investments are required for setting up authorised vehicle inspection centres. Therefore, the private sector would have to play a major role in setting up these centres. As per Section 56(2) of Motor Vehicles Act, 1988, the State Governments can approve setting up of private vehicle inspection centres. As discussed in Chapter 2, till now due to stay by Calcutta High Court no private sector could set up vehicle inspection centres. Since the apex court has vacated this order, private sector participation should not be a problem.

The State Governments would have to formulate tender documents for giving contracts to the private sector. This contract agreement would have to consider the following issues:

- Length on contract agreement (say 10 years)
- The list of tests to be done and type of vehicles to be inspected
- Presence of necessary equipment and infrastructure

- Financial guarantees required
- Technical expertise and competence

The State Government would have to invite bid from interested parties and based on the selection criteria's laid down award the contract to the competent and qualified bidder. The private sector could be given contracts for specific geographical areas. At present, there are limited players for manufacturing vehicle inspection equipment and setting up vehicle inspection centres. This is due to low demand in market for such items. Once the inspection program is mandated, the demand would increase, thus making the market more competitive. The mode of private sector participation could vary from place to place depending on problems and constraints faced in each area. Availability of land is a major problem in large metropolitan areas. In areas where there is excess of land, the Government could lease out the land to private sector for a fixed rent. The manpower and machinery could be provided by the private sector, which runs and operates the centres.

The mode of private sector participation could be detailed out in the tender documents prepared and issued by the State Government.

A phased implementation plan would have to be prepared to gradually introduce these centres in the city. Details of how a phased implementation plan can be prepared for introducing these inspection centres has been demonstrated for Mumbai city, given later in the Chapter.

Code of practice for inspection centres

A detailed code of practice needs to be defined by the government, which needs to be followed by the vehicle inspection centres. This Code of Practice should set out the details and criteria for the detection of vehicle defects or unsafe vehicle condition by inspection. This model code of practice is given in Annexe H.

Supporting measures

Human resources development

To introduce an effective inspection and maintenance program it would be necessary that government comes out with a workable training and capacity building program to be organised focussing on the following target groups:

- Staff, attendants and Motor Vehicle Inspector at the vehicle inspection centres.
- Auditors for auditing performance of inspection centres and staff of State Transport Department and the mobile squad for on road enforcement.

ining should also be imparted to the mechanics in the vehicle repair
tres so that they can repair the vehicles efficiently.

wareness campaign

umer awareness campaign should be launched with help of Schools, , community-based organizations, automobile associations and research tes. This mass consumer awareness campaign to be run on regular basis l focus on making consumer aware of the following issues:

lvantages of an inspection and maintenance program for a vehicle owner
hat is the process followed for inspection of a vehicle
w a vehicle owner must maintain the vehicles
equency of an inspection program
cations and list of authorized vehicle testing stations where inspection is rried out
les and duties of a vehicle inspection center
cation of authorized vehicle repair and maintenance centers
gal status of inspection program and fine imposed for offence committed.

les and responsibilities of various stakeholders could be summarised in ble 4.12.

ble 4.12 Roles and responsibilities

keholders	**Responsibilities**
tral Government	▪ Amendments in Act ▪ Co-ordinate I&M program ▪ Issue guidelines and manuals
tate Government	▪ Incorporate relevant changes in the State Rules ▪ Approve setting up of vehicle inspection centres ▪ Audit performance of centres ▪ Random checking of vehicles on road
raffic police	▪ On road enforcement
Private sector	▪ Set up inspection centres ▪ Grant a fitness certificate
Research institutes	▪ To arrive at test methodology for testing vehicles for mass emission system ▪ Emission inventory ▪ Design manuals and guidelines ▪ Design training modules and conducing training programmes
Vehicle and component manufacturers	▪ Vehicle repair and maintenance program ▪ Set up model vehicle inspection centre
NGOs, Media	▪ Consumer awareness campaigns

Maintenance program

An effective maintenance program is also an essential part of the overall strategy. If a vehicle is found unfit during inspection, it would be awarded an vehicle fail certificate. The vehicle owner has the choice of taking their vehicle to any vehicle repair centre from where they could get their vehicle repaired. The owner would then approach the vehicle inspection centre and would get the vehicle tested for the items on which it failed the test before. The objective here is to develop separate vehicle testing centres and vehicle repair centres. The vehicle manufacturers would need to authorise these repair centres. Less number of well servicing and authorised vehicle repair centres are better and effective than a large number of unauthorised vehicle repair centres. These would ensure that the owners get good repair and maintenance of their vehicles. In addition, the vehicle manufacturers should also give the vehicles owners a detailed manual giving guidelines and tips on maintaining roadworthiness of the vehicles.

Implementation Plan

Mumbai City has been selected for demonstrating how an implementation plan can be prepared for setting up vehicle inspection centres in a city.

A two phased approach has been suggested for ensuring effective implementation of inspection and maintenance program. A huge amount of investment would be required for setting up vehicle inspection centres; therefore it is essential to introduce the entire program in phases. The program has been phased out, prioritising the program for transport (commercial) vehicles and then moving on to the private vehicles. It also recommends for bringing older vehicles under the inspection regime earlier as compared to newer vehicles. The details of the plan are discussed in sections later in the text.

Phase 1

The phase I would focus on testing for commercial vehicles only (short term, immediate approach).

Phase 2

The phase 2 would focus on all types of vehicles (medium-long term approach) Since the legislation right now permits inspection of only commercial vehicles for introducing the inspection scheme for private vehicles would involve introducing amendment in the legislation which, would take time. Therefore it is recommended that inspection programme for private vehicles should be introduced in second phase only.

The emphasis of the phase II would be to strengthen the existing structure set up in phase I and introduce more vehicle inspection centres within the city for inspection of private vehicles and make additional facilities if required in the centres earlier inspecting only commercial vehicles.

City division

Mumbai City could be divided into three zones for purpose of implementation based on the existing RTO classification:

- Mumbai(Central)
- Mumbai (East)
- Mumbai (West)

The number of newly registered vehicles and Vehicles on road as on March 2000 is given in the Table 4.13.

Table 4.13 Number of newly registered vehicles on road

		Newly registered vehicles				Vehicles on road			
S.no	Category	Mumbai Central	Mumbai West	Mumbai East	Greater Mumbai Total	Mumbai Central	Mumbai West	Mumbai East	Greater Mumbai Total
1	Two-wheelers	7755	13470	6664	27889	143182	177653	86471	407306
2	Cars	9168	8603	2368	20139	157820	105805	39483	303108
3	Jeeps	209	134	246	589	12747	5409	4209	22365
4	Station wagons	2			2	2705	962	406	4073
5	Taxi cabs	2417	722	571	3710	37398	10861	10437	58696
6	Auto		4384	3091	7475		56242	41323	97565
7	Stage carriages	149			149	5278			5278
8	Contract carriages	91	81	81	253	1810	3720	906	6436
9	School buses	1	1		2	64	594	47	705
10	Private service vehicles	7	8	23	38	824	598	255	1677
11	Ambulances	24	12	9	45	890	280	148	1318
12	Trucks and lorries	113	43	26	182	9012	5334	3883	18229
13	Tankers	12	7	1	20	1200	113	707	2020
14	Delivery vans (4 wheelers)	240	408	70	718	9208	4414	4108	17730
15	Delivery vans (3 wheelers)	220	727	424	1371	3920	8503	3628	16051
16	Trailors	6	50	3	59	868	337	124	1329
17	Tractors	1	5	2	8	863	125	170	1158
18	Others	79		33	112	3712	445	529	4686
	Total	20494	28655	13612	62761	391501	381395	196834	969730

Source: Maharashtra Motor Transport Statistics, 2000

Inspection frequency

The proposed frequency for inspection for both commercial and private vehicle to get a vehicle inspected to get a valid road worthiness certificate is given in Table 4.14. The commercial or the transport vehicles should be inspected annually till about 9 years of the age of the vehicle. After 9 years, the vehicle should be inspected once in a year. The private vehicles need to go in for first inspection only after 3 years of registration except two wheelers which should go in for an inspection after 2 years. But all vehicles older than 3 years should go in for inspection after every two years and vehicles older than 9 years should go in for inspection annually.

Table 4.14 Proposed frequency for vehicle inspection

Vehicle Types	Frequency		
	<3 years	3-9 years	>9 years
Private vehicles	NA	Biennially	Annually
Commercial vehicles	Annually	Annually	Annually
	<2 years	2-8 years	>8 years
Motorcycles & scooters	NA	Biennially	Annually

Phasing Plan for Commercial vehicles

The phased implementation plan could include:

1. First year: All types of commercial vehicles that are more than five years old to be inspected in the first year.
2. Second year: All types of commercial vehicles that are less than five years old and have not been inspected in first year to be inspected in the second year.
3. Third year: Newly registered vehicles in First year + vehicles less than 9 years old inspected in first year to be inspected once + vehicles more than 9 years old inspected in first year inspected twice a year
4. Fourth year: Newly registered vehicles in Second year + vehicles less than 9 years old inspected in second year inspected once + vehicles more than 9 years old inspected in second year inspected twice a year

Based on the phasing plan, the no of vehicles estimated to be inspected is given in table 4.15

Table 4.15 Estimates of vehicles for inspection in Greater Mumbai

Inspection year	Vehicles to be inspected	No of vehicles in Mumbai	
		Petrol	Diesel
First	Vehicles more than 5 years old (Vehicles on road as in 1995)	94,952	50,586
Fourth year	Newly registered vehicles in First year + vehicles less than 9 years old inspected in first year to be inspected once + vehicles more than 9 years old inspected in first year inspected twice a year	130,132	65,782

Base year is 2000

The number of inspection centres to be set up in various parts of Mumbai for commercial vehicles is given in Table 4.16.

Table 4.16 Estimates of number of inspection centres for Greater Mumbai for testing commercial vehicles

Year	Mumbai Centre	Mumbai West	Mumbai East	Total Mumbai
First	3	2	1	6
Fourth	4	3	2	8

Phasing Plan for Private vehicles

The phasing implementation plan could include:

1. First year: All types of private vehicles (both petrol and diesel vehicles) that are more than five years old to be inspected in the first year.
2. Second year: All types of private vehicles (both petrol and diesel vehicles) that are less than five years old, but more than three years and have not been inspected in first year to be inspected in the second year.
3. Third year: From third year on wards all vehicles would follow the inspection schedule as mentioned earlier.

Based on the phasing plan, the number of vehicles to be inspected is given in Table 4.17.

Table 4.17 Estimates of private vehicles for inspection in Greater Mumbai

Inspection year	Vehicles to be inspected	No of vehicles	
		Petrol	Diesel
First	Vehicles more than 5 years old (Vehicles on road as in 1995)	491,377	30,468
Fourth year	vehicles older than 9 years as in 3rd year (Year 1996)	526,769	33,950

Base year is 2000

The number of inspection centres to be set up in various parts of Mumbai for (petrol and diesel) private vehicles is given in table 4.18.

Table 4.18 Estimates of number of inspection centres for Greater Mumbai for testing private vehicles

Year	Mumbai Centre	Mumbai West	Mumbai East	Total Mumbai
First	9	7	4	20
Fourth	15	13	7	35

Separate vehicle inspection centres would have to set up for different category of vehicles. These would depend on number of vehicles in a city of each category. There is also a need to establish in some cities the viability of the option of combining centres catering to different category of vehicles to make operation of these centres more commercially viable.

Implementation schedule

Various measures have been suggested for implementing the Inspection and Maintenance program in India. Table 4.19 details out the time plan for implementing these sets of recommendations.

Table 4.19 Time plan for implementing the program in India

	2003-2004 (quarters)				2004-2005 (quarters)				2005-2006 (quarters)			
	1.	2.	3.	4.	1	2	3	4	1	2	3	4
Amendments in relevant Acts				■	■	■	■	■				
Developing contents of an inspection program						■	■	■				
▪ Setting standards				■	■	■	■	■				
▪ Development of manuals					■	■	■	■				
Strengthening existing Institutional structure						■	■	■				
Develop a model vehicle inspection center							■	■				
Detailed work on emissions test procedures							■	■				
Developing training and capacity building modules				■	■	■	■	■				
Designing consumer awareness campaigns					■	■	■	■				
Developing a maintenance program					■	■	■	■				
Developing tender documents for private sector participation							■	■				
Designing consumer awareness campaigns												
Setting up vehicle inspection centres in a city												

Further work

Some further work needs to be done in order to effectively implement the I &M program within the broad framework as suggested earlier in this chapter. This includes the following work.

Development of manuals

Detailed manuals need to be developed. These manuals would prescribe the procedure for testing a vehicle, tests to be conducted, and method for conducting the tests and reasons for failures. These manuals would have to be prepared for different categories of vehicles and should be available with all test centres and others concerned with the I&M program.

1. Public service vehicle inspection manual
2. Motor cycle testing manual
3. Car and light commercial vehicle testing manual
4. Heavy goods vehicle inspection manual
5. Trailers and tractors vehicle inspection manual

A handbook for administrators would also need to be prepared specifying roles, responsibilities of the inspectors in the vehicle inspection center, the auditors and other agencies involved.

Training modules

Training modules need to be prepared for the target groups as identified earlier that specifies the contents of the program, schedule of the program, duration of the program, period for refresher courses.

More work on tests to be adopted for emission measurement

Further work needs to be done to fix more stringent emission norms for the new category of inuse vehicle. The type of emission tests to be done for phase I by the vehicle inspection centres, needs to be identified and the tests modified based on the Indian driving cycle.

Developing tender documents

The Central Government as a regulator would have to formulate guidelines for private sector participation in establishing the inspection centres in India. The State governments would invite the tender from prospective bidders, evaluate them and select successful bidders and award contracts to private parties that are capable of setting up and operating inspection centres in Indian cities.

Setting up model inspection centre

A model inspection centre would have to be set up to demonstrate the procedure for testing the vehicle, list of tests to be done, equipment used and general layout of the centre. A team of experts could monitor the working and performance of this centre and it could act as an opportunity to experiment and come up with a practical and financially viable scheme for replicating such vehicle inspection centres.

A Questionnaire

Institutional and regulatory structure

1. What are the relevant acts /rules and section of these acts (state acts) governing inspection and maintenance of inuse vehicles in your state?
2. What agencies are responsible and involved in granting a fitness certificate for inuse vehicles?
3. What are the responsibilities and functions of State Government (Transport Department) and the Private sector in inspection and maintenance of in use private and commercial vehicles.
4. What is the procedure of registration of vehicles? Is it one time registration or do you have a annual vehicle registration system.
5. What mechanism are followed for enforcing I&M scheme for vehicles on road? What agencies/ institutions are responsible for it?
6. What are the institutional and regulatory arrangements for monitoring the performance of the centres?
7. What are the arrangements for auditing the quality of inspection carried out by the centres?
8. What fine/ punishment is there is a vehicle is found not possessing a valid fitness certificate?
9. What are the proposals/ suggestions of the State Government to improve the efficiency and effectiveness of the inspection and maintenance program?
10. What role of private sector do you envisage in setting up inspection and maintenance centres in your state?

Motor vehicle inspection centers

General information

1. Name of the Centre
2. Location of the Centre.(Centrally located or not)
3. Approximate area of the centre.

Inspection Details

1. What tests are conducted for private/ commercial vehicles
   - Safety
   - Environment
2. On which parameters are tests conducted
3. What is frequency of conducting these tests
4. What is the fees for conducting these tests
5. What are the criteria for granting fitness certificate
6. Which documents are verified before accepting the vehicle for fitness check
7. Approximate number of vehicles, heavy/ medium/ light, reporting at the centre daily
8. Number of vehicles inspected daily, category-wise
9. Average time spent on inspection of each vehicle, category-wise
10. What percentage of vehicles are found fit?
11. What are common deficiencies observed
12. What procedure is followed , if a vehicle is found unfit

Infrastructure

1. Number of Test Bays/Test Tracks
2. List of equipment's available with test centre
3. Type of equipment:
   i) Automatic
   ii)Semi automatic
   iii)Manual
4. How are the equipment's maintained and calibrated

Human resources

1. Designation & Qualifications of Head of the Centre
2. Number of employees : (i) Technical (ii)Non-technical
3. What are the minimum qualifications
4. Are they being given regular training

5. Working hours

Observations and comments

1. Do you think the centre is well equipped/staffed

2. Is the budget for running these centres adequate?

3. Do you feel the non-transport vehicles, including two-wheelers should also be brought under regular fitness rules. If so after what interval.

4. Do you think the number of such centres in your city are sufficient? If not, what should be approximate number of stations per 10,000 vehicles

5. Please furnish a brief note indicating the procedure followed for grant of a fitness certificate.

B

Safety checks for commercial Vehicles

Table 1: List of safety items to be checked for commercial vehicles as per the amendments to the CMVR Act, 1989

Item	Check Fitment	Check make / type/ rating, etc.	Check conditions	Check functioning	Test	Remark
Brake testing	Yes	No	Yes	Yes	Yes	Checking of service brake, emergency brake and parking brake. Checking of efficiency by the use of brake tester. Physical checking for leakages.
Lighting and signaling devices including front and rear position lamps, registration plate lamp, head lamp, stop lamp, parking lamp, direction & hazard warning devices, head lamp	Yes	Yes	Yes	Yes	Yes	Head lamp beam focus using head -lamp tester for luminosity and beam pattern. Check the functioning of all other lamps Ensure proper head light bulb wattage. Ensure no unauthorized lights are fitted.
Speedo-meter	Yes	No	Yes	Yes	No	Using the speedometer tester.
Wheel alignment	No	No	No	No	Yes	Use the side -slip tester.
Noise	No					Use sound level meter
Horn	Yes	No	Yes	Yes	Yes	Use sound level meter
Tyres	Yes	Yes	Yes	No	Yes	Check the tread depth

Sr. No	Item	Check Fit-ment	Check make / type/ rating, etc.	Check conditions	Check functioning	Test	Remark
							using depth gauge. ply rating and size.
8.	Spark plug/ suppressor cap/ high tension cable	Yes	Yes	Yes	No	No	-
9.	Reflectors	Yes	No	Yes	No	No	Ensure colour of refle and reflective tapes a per rule 104.
10.	Rear view mirror	Yes	No	Yes	No	No	-
11.	Safety Glass	Yes	Yes	Yes	No	No	Laminated windscree glass is used for vehic manufactured from A 1996 onwards.
12.	Dash-board equipment	Yes	No	Yes	Yes	No	-
13.	Wind-shield wiper	Yes	No	Yes	Yes	No	-
14.	Steering gear	Yes	No	Yes	Yes	Yes	Check the free play.
15.	Seat belts	Yes	No	Yes	Yes	No	Check the condition a proper fitment.
16.	General condition of the vehicle including vehicle structure, body security, body condition, doors, load security, spare-wheel and carrier, seats, suspension, fuel system etc.	No	No	Yes	No	No	Physical checking.
17.	Overall dimension	-	-	-	-	-	Check all the dimensi

C

International Literature review

Japan

Contents of the program

The tests are divided in five blocks Block-A to Block-E. The details of which are given below.

Block-A: visual confirmation test consisting of:

- confirmation of identity of a particular vehicle by chassis number
- functionality and physical verification of lighting systems and lamps
- mirror – conditions
- operation of windshield wipers
- seatbelts and head restraint devices
- wear off tyre tread etc.

Block-B: inspection by test equipment.

- Sideslip test: the motor vehicle is run straightforward on the platform of tester and then the amount of the wheel sideslip is measured. The standard specifies that the measured value shall be 5 mm or less when running on the tester.
- Brake test: the wheels are placed on two spline shaped rollers and braking force is measured by the rotating rollers. The total braking force of right and left wheels together shall not be less than 50 % of the total vehicle weight. The difference between the braking forces of right and left wheels shall be less than 8 % of axle weight.
- Speedometer test: while the wheels of the motor vehicle are rotated constantly so that the speedometer indicates 40 kmph, the indication of the speedometer is measured. +4.4 /– 5.5 km/h error is permissible.

Block-C: inspection by test equipment

- Exhaust emission test (idling CO and HC measurement)
- Headlight test – condenser type headlight testers are used to measure brightness of the headlamps and the deviation of the photometry axis on the high beam

Block-D: under body inspection (pit type)

Inspection of:

- Brake fluid leakage from brake hose, pipe etc and damages thereof.
- Looseness and damages of steering system
- Water leakage's from radiator
- Play and distortion of propeller shaft joint
- Oil leakage's and deformation of shock absorber
- Damage of exhaust pipe
- Damages to catalyst and heat shielding plate

Block-E: control room for inspection equipment
Engineer controls the control line and makes the final decision whether the motor passed the inspection or not

Inspection tests

Type of Inspection

No motor vehicle is permitted to be operated on the road, unless it has passed the inspection to be conducted by the Minister for Transport pursuant to the pertinent Laws and Ordinances and it has been granted a valid motor vehicle inspection certificate.

Major types of inspection are as follows:

1. Initial Inspection:
   Inspection to be performed when a motor vehicle is to be operated for the first time. Used cars without the number plate shall also be subject to this inspection.
2. Renewal Inspection:
   Inspection to be performed when a motor vehicle is to be operated continually beyond the expiry date of the motor vehicle inspection certificate.
   The valid term of the motor vehicle inspection certificate is given in Table 1

Table 1 Valid term of the motor vehicle inspection certificate

Examples of Type of Motor Vehicles	Valid Term
New passenger cars for private use	3 years
Passenger cars for private use (excluding those listed in the preceding) Large-sized special motor vehicles and mini-sized trucks	2 years
Taxis, buses for business use, trucks, tank lorries, buses for private use, motor vehicles for kindergarten children	1 year

3. Modification Inspection:
   The inspection to be performed when a motor vehicle has been modified to cause changes in its length, width, and/or maximum loading capacity.
4. Reassembling Inspection:
   Inspection to be performed when a motor vehicle has been disassembling repaired.
5. Preliminary Inspection:
   Inspection granted to car dealers, etc. for motor vehicles as their merchandise to confirm conformity with safety regulations before specific users are determined for the vehicles.

A colour coding system has been adopted to identify the year of expiry of the certificate. For example, green was assigned to 1999, orange for 1998, blue for 1999 and red for 2000.

Brief description of motor vehicle inspection and maintenance service systems in Japan

The road vehicles Act has stipulated details of the motor vehicle inspection and maintenance service systems which aim at ensuring the safety of motor vehicles and prevention of environmental pollution. Following is a brief description of them.

Safety regulations for road vehicles

No motor vehicle is permitted to be operated on the road, unless its construction and devices have conformed to the requirements set forth in the Safety Regulations for Road Vehicles.

Concrete standards have been prescribed for the steering system, braking system, lighting system and so forth in the case of the safety-related items; the exhaust emission control system, noise control system and so forth in the case of the environmental pollution-related items.

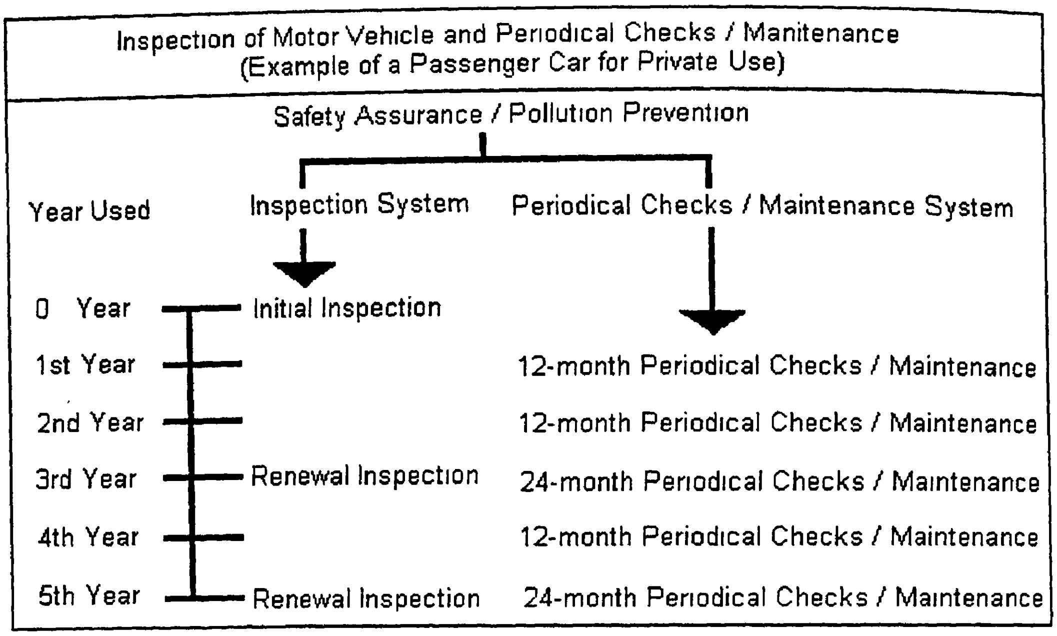

Inspection of Motor Vehicle and Periodical Checks / Manitenance
(Example of a Passenger Car for Private Use)
Safety Assurance / Pollution Prevention
Year Used
Inspection System
Periodical Checks / Maintenance System
0 Year
Initial Inspection
1st Year
12-month Periodical Checks / Maintenance
2nd Year
12-month Periodical Checks / Maintenance
3rd Year
Renewal Inspection
24-month Periodical Checks / Maintenance
4th Year
12-month Periodical Checks / Maintenance
5th Year
Renewal Inspection
24-month Periodical Checks / Maintenance

Figure 1: Frequency of inspection and maintenance checks

Application fees for registration

Application fees for the motor vehicle inspection and registration are determined by the "Ordinance Concerning the Fees Related to the Road Vehicles Act." Main application fees for motor vehicle inspection and registration vary by the type of application as follows:

- New Registration \700
- Transfer Registration \600
- Alternation Registration \350

Application fees for inspection

Table 2 Initial Inspection fees

▪ Upon presentation of completion Inspection Certificate. Conformity Certificate with Safety Regulation Limited Motor Vehicle Inspection Certificate and Limited Conformity Certificate with Safety Regulation	1,100 Yen
▪ Upon presentation of Limited Motor Vehicle Inspection Certificate (excluding 1 above)	1,200 Yen
▪ Other Motor Vehicles	
Small-sized Motor Vehicles	1,400 Yen
Ordinary-sized Motor Vehicles or Large-sized Special Motor Vehicles	1,500 Yen

Table 3 Renewal Inspection

▪ Upon presentation of Conformity Certificate with Safety Regulation Limited Motor Vehicle Inspection Certificate and Limited Conformity Certificate with Safety Regulation 1,100 Yen	
▪ Upon presentation of Limited Motor Vehicle Inspection Certificate (excluding 1 above)	\1,200 Yen
▪ Other Motor Vehicles Small-sized Motor Vehicles, Large-sized Special Motor Vehicles or Ordinary-sized Motor Vehicles	\1,400 Yen \1,500 Yen

Singapore

Contents of the program

A complete inspection include:

- Side Slip Test / Alignment Test (for motorcycles)
- Brake Efficiency Test
- Taximeter Test (for taxis)
- Sound Level Test
- Headlight Test
- Emission / Diesel Smoke Test
- Above Carriage Inspection
- Under Carriage Inspection

The parameters covered for emission testing are CO, HC, CO2 and NO

Certification is a comprehensive mechanical and operational inspection using the latest computerised diagnostic equipment. The process consists of a 120-point check witch includes the following: -

- Chassis frame damage due to accident
- Engine running condition
- Line Inspection for all wheels
- Alignment check and brake test
- Bodywork/paintwork/Structural
- Corrosion
- Interior/Upholstery
- Electrical System
- Oil Leakage
- Road Tax

Inspection tests

Duration of inspection process

On an average, the duration of inspection process is approximately 7-15 minutes, depending on the type of vehicle.

Documents required

- Road tax renewal notice
- Valid insurance cover note
- Valid Inspection Certificate (if applicable)
- Clearance Form (for vehicle tagged by LTA)
- Vehicle Parking Certificate (only for Heavy Goods Vehicle)

Visible checks

- Functioning of all signal & warning lights
- Check tyres for baldness & side bulging
- Check function of horns, wiper & washer
- Check level of brake oil

Maintenance schedule

The vehicles that are found unfit during inspection are sent again for repair to authorised repair and maintenance centres and again called for inspection till the vehicle passes the tests.

Random inspection

To ensure that all vehicles are maintained well such that these meet the standards at all times; the LTA and environment ministry carries out random inspections. Inspections are carried out by mobile inspection vans. Violators are punished with monetary fines, which increases with the offence.

Emission Testing Technologies

Three main types of emissions tests are used on in-use vehicles: the idle (or two-speed idle), the steady state loaded test and the IM240.

The idle test has been used in VIS programs for many years and involves running the vehicle at idle (or high idle) and using an emissions analyser to take a sample of the exhaust. The analyser uses infrared absorption to measure the concentration of hydrocarbons (HC), carbon monoxide (CO) and carbon dioxide (CO2). The analyser actually measures the concentration of hexane in the exhaust and this is used as an estimate of the hydrocarbon emissions assuming a typical gasoline mixture.

The steady-state loaded mode test measures the emissions when the vehicle is at a steady speed and load on a dynamometer. The analyser system is the same one used for idle testing with the addition of a second bench to measure nitrous oxide (NO). NO can be reliably measured as the vehicle is operating under load. Different NO benches use different technologies including infrared absorption, chemical catalyst and chemiluminescence.

There are a number of different loaded mode tests in use and under consideration with most attention to the ASM 5015 and ASM 2525. ASM stands for Acceleration Simulation Mode and these tests use a high load at low speed to simulate the vehicle operation under acceleration. This produces the most representative NO readings.

The first two digits of the ASM test (50 for the ASM 5015) represent the load and the second two digits the speed (15-mph for the ASM 5015).

The IM240 test measures the emissions while the vehicle is on a dynamometer following a driving trace with accelerations and declarations of a typical urban driving. Pattern. The full test takes 240 seconds (hence the name IM240) and dynamometer provides inertia simulation so that the vehicle experiences the same load it would normally experience accelerating or decelerating on the open road. The analyser system collects the full exhaust from the vehicle (not just a sample) and measures the total emissions in grams per mile driven (not just the concentration). The analyser uses a flame ionisation device (FID) to measure the total hydrocarbons (all types of hydrocarbon not just hexane) and can therefore be used on vehicles using a variety of fuels. The analyser measures CO and CO2 by infrared absorption and NOx (the total NO and NO2) by chemiluminescense.

New York

Contents of the program

New York requires both safety inspection and emissions inspection every 12 months and whenever a vehicle is transferred. Both inspections are done at the same time by a DMV-certified inspector at privately owned stations licensed by DMV. *Trailers, light trucks and motorcycles are also subject to an annual inspection.

The following safety equipment must be in good condition at all times, and is evaluated when a vehicle is subjected to New York State inspection.

Seat Belts

- Inspect for proper operation and anchorage.
- Model years 1969 and newer - one seat belt is required for each seating position.
- Model years 1967 and 1968 - two front seat belts are required (driver position included), and one seat belt is required for each seating position elsewhere in the vehicle.
- Model years 1965 and 1966 - two front seat belts are required (driver position included).

Brakes

- At least one front wheel must be removed to inspect brakes.
- Brake pedal reserve - brake pedal must have 1/3 reserve.
- Brake pedal fade - brake must hold for one minute without fading.
- Power brake unit - check for damage.
- Brake master cylinder - check for leakage and proper fluid level.
- Disc brake pads - check condition.
- Drum brake linings - thickness of linings must be at least 1/16 inch on bonded linings or at least 1/32 inch over rivet head on riveted linings, with no loose or missing rivets or lining.
- Brake drums and/or rotors - check condition.
- Wheel cylinders and/or callipers - check for leakage.
- All brake lines and hoses - check for leaks, cracks, and improper support, flattened, etc.
- Parking brake - check for components and function.
- Brake equalisation - test vehicle for a straight stop without significant wheel pull.

Steering, front end, suspension, chassis, frame, wheel fasteners

- Front-end assembly - check condition.
- Steering wheel plays - check for excessive freeplay.
- All steering linkage - check for tightness or binding, excessive wear and/or looseness in parts, including idler arm, centre control arm, tie-rod ends, drag link ends, steering and pitman arms
- Gearbox, cross shafts, bushings, wheel bearings, steering column or steering wheel shaft mounting.
- Power steering - check operation, condition of belt, and for leakage.

- Shock absorbers - check shock mountings and for broken or missing shock absorbers.
- Springs and torsion bars - check for sagging or broken springs, or a broken, disconnected, missing or bent torsion or stabiliser bar.
- Chassis/frame - check for breaks. cracks, or severe rust at the suspension attachment points.
- Wheel fasteners - check for missing or broken parts.
- Each Tire (Except spare)
- Tread depth - must be at least 2/32 inch when measured in two adjacent major tread grooves showing the most wear.
- Tire condition - check for any fabric break or cut over I inch, visible bumps, bulges or knots, and any restricted use designation on the tire.

Lights

- All lighting must be of an approved type and inspected for operation, proper mounting, and broken or missing lenses:
- Headlights (low and high beam).
- Check aim for low beam headlights.
- Tail lamps.
- Stop lamps.
- Directional signals.
- Backup lights (1969 and newer).
- License plate lights.
- Hazard warning/four-way flasher (1966 and newer).
- Directional signal indicator.
- Windshield And Other Glass
- Windshield - check for presence and condition.
- All windows - approved safety glass or rigid plastic and condition.
- Windshield Wipers And Blades
- Wipers - check for presence and operation.
- Blades - check condition.
- Horn
- Check mounting and operation.
- Mirrors
- Check mirror location and mounting, and for cracks, breaks, or discoloration:
- Model year 1970 and newer - check adjustable interior and left outside mirror-.

- Model year 1968 and 1969 - check interior mirror and one left outside mirror. 1967 and older - check interior mirror or left outside mirror.

Inspection tests

Emissions Inspection for gas powered vehicles

Beginning in January 1998, the inspection and maintenance program used in the New York Metropolitan Area (NYMA) was upgraded to meet new federal standards. The NYMA includes the five boroughs of New York City, and Nassau, Suffolk, Rockland and Westchester Counties. All gas powered vehicles, will with few exceptions, registered in the NYMA, and is subjected to a high-enhanced emissions inspection. Inspection facilities in the other 53 counties can not perform this required inspection. However if a vehicle is registered in the NYMA and the inspection expires while the vehicle is located in one of the other 53 counties the operator may acquire a "Temporary Certificate of Emission Waiver" (VS1078) from any DMV office. A licensed qualified inspection station may perform the appropriate upstate inspection on the vehicle if the VS1078 is presented. However a complete High enhanced Emissions and a safety inspection must be conducted within 10 days after the vehicle renters the NYMA.

About the Test

The emission inspection test is a comprehensive inspection of a vehicle's air pollution control system and exhaust emissions using sophisticated testing equipment. All vehicles receive a gas cap integrity check and a visual inspection to detect tampering or malfunction in the air pollution control devices. Testing is done annually at the same time as the safety inspection. The emissions test fee is $25, plus $10 for the safety inspection. The fee reflects additional labour and testing equipment costs.

The test varies according to the vehicle's age, weight and type, as follows:

- 1981 and newer models weighing 8,500 pounds or less are checked for excessive emissions using dynamometers. 1996 and newer models also undergo a check of the vehicle's on-board diagnostic computer.
- Vehicles prior to model year 1981, weighing more than 8,500 pounds or equipped with full-time traction control or all-wheel-drive receive the idle speed tail pipe test only.

Emissions Inspection Diesel Powered Vehicles

Beginning June 1, 2000, all diesel powered vehicles registered in the five boroughs of New York City, or the counties of Nassau, Suffolk, Rockland or Westchester Counties with a gross vehicle weight (GVW) of 8,501 pounds or more must undergo an emissions inspection performed at the same time as the annual safety inspection.

Type of diesel-powered vehicles subjected to annual emissions inspection

All diesel-powered vehicles with a gross vehicle weight (GVW) of 8,501 pounds or more which are registered in New York City or the counties of Nassau, Suffolk, Rockland or Westchester must undergo annual emissions inspection. There are no exemptions based on the vehicle's model year, etc. Diesel-powered vehicles with a GVW of 8500 pounds or less are not subject to annual inspection. Vehicles registered outside New York City or the counties of Suffolk, Nassau, Rockland or Westchester are exempt from the annual diesel inspection.

Location of annual inspections

At Diesel Emissions/Safety Inspection Stations licensed by DMV, at the same time as the annual safety inspection. A station must have special equipment, and must be licensed as a diesel emissions inspection station by DMV, to perform diesel inspections. A station, which currently performs emissions inspection of gasoline-powered vehicles, cannot automatically perform diesel emissions inspections. These stations are licensed as diesel emissions inspection stations. The station will issue a "Safety/Diesel Emissions" inspection sticker valid for one year. If the vehicle is subject to a heavy vehicle inspection (generally vehicles over 18,000 pounds GVW), a Heavy Vehicle Inspection sticker will also be issued.

An inspection must be done in a licensed inspection station displaying an official sign, and must be performed by a certified motor vehicle inspector. If your vehicle fails the safety and/or emissions inspection, the inspection station may not repair it, or attempt to repair it, without owner's authorisation.

Illinois

Testing procedure

Step One

A certified inspector enters vehicle data into the computer.
Driver and passengers leave the vehicle and go to the waiting booth to observe the test. The gas cap is tested to ensure fuel vapour is not escaping.

Step Two

A certified inspector moves the car into position to conduct the exhaust emissions test. The lane computer determines the test type and standards for your vehicle. Emissions are gathered from the tailpipe and analysed.
Depending on the test required, the vehicle is tested on a treadmill called a dynamometer for up to four minutes, or the vehicle is given an idle test.
The on-board diagnostic system of newer vehicles will be checked for the proper operation of the emissions control system.

Step Three

The lane computer compares results to standards and prints the vehicle inspection report. If the vehicle passes, the vehicle inspection report includes a compliance certificate. If the vehicle fails, the motorist receives a vehicle inspection report and a repair diagnostic report with useful information for making the required repairs.

The enhanced emissions test accurately measures emissions from today's computer-controlled vehicles. It uses a dynamometer, which is a set of rollers that allows the vehicle to run at various speeds, to effectively identify polluting vehicles. During the test, a certified inspector places the vehicle on the dynamometer and operates the vehicle in a cycle that simulates a two-mile urban trip. The exhaust stream is collected, analysed and compared against standards for that vehicle's model type and year. A gas cap pressure test is also performed as part of the emissions test to ensure that the cap is free of leaks.

Arizona

Contents of program

Arizona law requires all vehicles registered in metro Phoenix or Tucson to be inspected within 90 days of the date the current registration expires unless:

- The vehicle model year is 1997 or newer, except alternative fuel vehicles.
- The vehicle is older than 1967. The vehicle is pro-rated (licensed in more than one state).

- The vehicle is non-motorised or is a trailer.
- The vehicle is electric powered, a golf cart, or has an engine displacement of less than 90 cubic centimetres

Inspection tests

Diesel Vehicle Testing

All 1967 and newer diesel powered vehicles registered within the Emissions Control Areas of metro Phoenix and Tucson are required to be emissions tested annually. The only exception is for pro-rated vehicles (those commercial vehicles which are licensed in multiple states).

Diesel emissions testing in Pima County and for light-duty (8500 lbs GVW and less) vehicles in Maricopa County consists of loading the vehicle on a dynamometer and measuring the opacity of the exhaust plume.

The measured opacity must not exceed the established standard. The standard is determined by the average elevation of the registration area. In Pima County the standard is 30 percent opacity. In Maricopa County the standard is 20 percent opacity.

Heavy-duty (8501 lbs and greater) diesel vehicles in Maricopa County are tested using the Society of Automotive Engineers J1667 test protocol, commonly referred to as the"snap-acceleration test." The test consists of measuring the opacity of three, wide open throttle, no-load accelerations from idle to maximum governed engine speed with the transmissions in neutral. The average opacity for the three accelerations cannot exceed applicable standard for the model year of the engine. The standard for engine model year1991 and newer is 40 percent opacity, for engine model year 1990 and older the standard is 55 percent opacity. Light duty diesel powered vehicles may be tested at any of the Vehicle Emissions Inspection Stations in Maricopa or Pima Counties.

Station personnel must operate all diesel vehicles driven on a dynamometer. The driver will be asked to exit the vehicle or move to the passenger seat. The person delivering the vehicle for testing will operate vehicles tested using the snap-acceleration test.

In addition to the opacity test, the vehicle will be checked for the presence of an appropriate fuel tank cap.

New Vehicle Exemption

Effective August 21, 1998, Arizona exempts from emissions testing all vehicles of the newest five model years. This year, 1997 and newer model year vehicles (except reconstructed vehicles and alternative fuel vehicles) are not required to be tested. An in lieu fee* will be assessed with the vehicle registration. Exempted vehicles may be inspected, if the owner wishes, in order to meet manufacturer's warranty requirements. The emissions inspection certificate must be submitted with the vehicle registration payment, and the "EIF"fee may be deducted from the registration total.

United Kingdom

Initially test-which became known as the 'MOT' test – was limited to braking, steering and lighting equipment. New items and different standards have been introduced from time to time, including:

- 1968 – a tyre check;
- 1969 – a check for the presence of legally required seat belts;
- 1977 – checks of windscreen wipers and washers, direction indicators, stoplights, horns, exhaust system and condition of the body structure and chassis together with a more detailed check on seat belts;
- 1991 – checks of the exhaust emissions for petrol engine vehicles, together with checks on the anti-lock braking system, rear wheel bearings, rear wheel steering (where appropriate) and rear seat belts;
- 1992 – a stricter tyre tread depth requirement for most vehicles;
- 1993 – checks of the rear fog, hazard-warning and number-plate lamps; and of the driver's view of the road, body condition, body security, load security, doors, registration plates, fuel system and mirrors;
- 1994 – a check of emissions for diesel engine vehicles, after minor procedural changes were put into place;
- 1996 – new and stricter emissions checks for spark ignition engine vehicles.
- 1998 – seat belt installation check introduced for minibuses and buses.

Contents of the program

The inspection program in UK covers both the parameters on safety and environment. These parameters are:

- Lighting Equipment, Stop Lamps, Reflectors, and Direction Indicators
- Front and rear position lamps, rear registration plate lamps, rear fog lamps Headlamps
- Stop lamps
- Rear reflectors
- Direction indicators and hazard warning devices
- Headlamp aim

Steering (including suspension)

- Steering control
- Steering system
- Power steering
- Suspension - general
- Front suspension, front wheel bearings and driveshafts
- Rear suspension and rear wheel bearings
- Shock absorbers

Brakes

- Parking brake lever mechanism
- Hand operated brake control valves
- Service brake control
- Anti-lock braking system
- Mechanical brake components
- Hydraulic, air and vacuum systems
- Brake performance

General Items

- Tyres
- Roadwheels
- Seat Belts
- Drivers view of the road
- Wipers
- Washers
- Windscreen
- Audible warning (horn)
- Exhaust system
- Exhaust emissions -petrol & diesel

General condition of vehicle -

- vehicle structure
- body security
- body condition
- doors
- load security
- spare wheel and carrier

- seats
- Mirrors
- Fuel system
- Registration plates and VIN details

Institutional structure

The Inspectorate also tests certain vehicles. The majority of these tests are either on Heavy Goods Vehicles (HGV) – under the Goods Vehicles (Plating and Testing) Regulations 1988 or on Public Service Vehicles (PSV) – Class VI in the Motor Vehicles (Tests) Regulations 1981. Some tests are also carried out on other classes within the Motor Vehicles (Tests) Regulations 1981 although these are normally only of Class V, Class VII, goods vehicles of 2,000kg or more in Class IV and vehicles of other classes which cannot be readily accommodated in other VTSs (usually because of size).

The testing of vehicles is conducted principally at commercial garages (AEs) and by some local authorities (Designated Councils). Both are authorised by the Vehicle Inspectorate and known as Vehicle Testing Stations (VTS). Any individual person, persons in partnership or company may apply to VI's local office on form VT1 to become an AE, authorised to carry out MOT testing of specified vehicle Classes. Designated Councils may also carry out MOT testing. Their legal position, and that of the 'examiners' who carry out tests on their behalf, differs somewhat from that of AEs and NTs. For most practical purposes, though, Designated Councils and their 'examiners' are treated as if they were AEs and NTs respectively. In particular, Designated Councils are required to have appropriate persons attend AE training courses in the same circumstances as for AEs.

Nominated Testers (NTs) are those persons employed by AEs to carry out and personally supervise MOT tests and to sign test certificates? In this context, personal supervision means supervision which is close enough for the NT to make all decisions on passing or failing every testable item on a test; this will involve not only closely observing every part of the test but also, in some cases, handling components to determine for example, the degree of wear in a competent or the amount of 'give' due to corrosion.

Taxis and private hire vehicles that are licensed by certain authorities do not need to have a MOT certificate. This applies only where the authorities are certified by the Secretary of State as empowered to issue their own exemption certificates. Exemption certificates cannot be issued until the relevant vehicle has been tested by or on behalf of the Authority to standards that at least equal those for MOT tests.

VTSs and their staff are subject to inspections by VI to ensure that testing is properly carried out. VI must approve test equipment used. Only specifically authorised people may conduct tests and sign official test documents. VTSs may only test those classes and types of vehicle that they are authorised to test and which are of a size and weight that can be accommodated on the authorised test equipment.

This is a national system and is not administered by regional authorities; the Vehicle Inspectorate administers it. All centres must follow the rules set down in the Guide and the Manual. The vast majority of VTS offer a maintenance facility to customers. The customers may or may not choose to use this service, for which they would pay the VTS the fees set at their own commercial rates. This maintenance service is not part of the statutory testing scheme. The owners may have the vehicles wherever they wish, or do it themselves.

Inspection tests

The vehicles subject to test under the Regulations are divided into the following classes, which are given in Table 4

Table 4 Description of vehicles and test requirement age

Class	Description	Age first test required (years)
I	Motor bicycles (with or without sidecars) up to 200cm^3	3
II	All motor bicycles (including Class I) (with or without sidecars).	3
III	Three-wheeled vehicles not more than 450 kg unladen weight. (Three-wheeled vehicles more than 450 kg unladen are in classIV)	3
IV	Cars, passenger vehicles, motor caravans and dual purpose vehicles in all cases with up to eight passenger seats	3
	Goods vehicles not exceeding 3,000 kg Design Gross Weight (DGW)	3
	Taxis and ambulances in either case with up to eight passenger seats	1

Class	Description	Age first test required (years)
	Passenger vehicles, ambulances, motor caravans and dual purpose vehicles in all cases with up to eight passenger seats that Are fitted with no more seat belts than the minimum required because of their construction; or Are identified as having been fitted with a type approved seat belt installation when built; or Have been tested as class IVA, VA or VIA (PSV) with at least the same number of seat belts as are currently fitted	1
See Notes 1,2,3 and 4		
IVA	The class IVA test is the normal class IV test with the addition of a check on the installation of certain seat belts. Passenger vehicles, ambulances, motor caravans and dual purpose vehicles in all cases with nine to twelve passenger seats that: Are fitted with more seat belts than the minimum required because of their construction and: Are not identified as having been fitted with a type approved seat belt installation when built; or Have not been tested as class IVA, VA or VIA (PSV) with at least the same number of seat belts as are currently fitted.	1
See Notes 1, 2, 4 and 5		
V	Private passenger vehicles, ambulances, motor caravans and dual purpose vehicles in all cases with thirteen or more passenger seats (including community buses, etc.) that: Are fitted with no more seat belts than the minimum required because of their construction; or Are identified as having been fitted with a type approved seat belt installation to all seats when built; or Have been tested as class VA or class VIA (PSV) with at least the same number of seat belts as are currently fitted.	1
See Notes 4 and 6		
VA	The class VA test is the normal class V test with the addition of a check on the installation of certain seat belts. Passenger vehicles, ambulances, motor caravans and dual	

Class	Description	Age first test required (years)
	purpose vehicles in all cases with thirteen or more passenger seats (including community buses, etc.) that:	
	Are fitted with more seat belts than the minimum required because of their construction and:	1
	Are not identified as having been fitted with a type approved seat belt installation when built; or	
	Have not been tested as class VA or class VIA (PSV) with at least the same number of seat belts as are currently fitted.	
See Notes 4 and 6		
VI and VIA	Public service vehicles (PSVs).	1
See Note 7		
VII	Goods Vehicles over 3, 000kg up to and including 3,500kg DGW	3
See Note 6		

NOTE 1: Diesel-engine vehicles can only be tested where specific authorization has been granted

NOTE 2: Spark ignition engined vehicles within Class IV and first used on or after 1 August 1992 can be tested only by VTSs that have fully compiled with the requirements set out in Section B5.

NOTE 3: Taxis included in this table are those, which are not exempt from MOT testing – see section C.

NOTE 4: Please refer to the appropriate MOT Inspection Manual to find out the minimum number of seat belts required on a particular age and type of vehicle.

NOTE 5: Class IVA tests may only be carried out at class V test stations.

NOTE 6: Spark ignition engined vehicles within Class V and VII first used on or after 1 August 1994 can be tested only by VTSs that have fully compiled with the requirements set out in Section B5.

NOTE 7: This Guide does not cover the testing of these vehicles, which is carried out at Vehicle Inspectorate Testing Stations and other specifically designated premises by inspectorate staff.

Petrol and Gas Powered vehicles

Vehicles to be tested

In-use exhaust emissions testing is applied to all petrol and gas powered vehicles with four or more wheels. Wankel rotary engined vehicles first used before 1st August 1987 and all kit-cars and amateur built vehicles (except those, which from 1 May 1988 are required to obtain Single Vehicle Approval) will be considered as vehicles first used before 1st August 1975. The test does not apply to vehicles fitted with 2-stroke engines.

Type of test

The emissions tests to which a vehicle is subject will depend upon its date of first use (date of registration) as follows:

- For vehicles first used before 1st August1975 a visual test will be applied
- For vehicles first used on or after 1st August 1975 a metered test will be applied.

On January 1996 a new test was introduced for petrol fuelled passenger cars fitted with advanced emissions control systems such as three way catalytic convertors. The test was extended to include large petrol fuelled passenger cars and petrol fuelled light goods vehicles from 1st August 1997.

- All passenger cars first used on or after 1st August 1995
- Other vehicles, such as large passenger cars and light goods vehicles first used on or after 1st August 1994
- For all petrol engined vehicles first used before 1st August 1992, for all gas-engined vehicles and for vehicles other than passenger cars first used before 1st August 1994 the test procedure consist of a simple check at the normal idle speed; the so called "non-catalyst" test.

Some passenger cars first used during the "transition"period (i.e. 1st August 1992 to 1st August 1995) and some light goods vehicles and large passenger cars first used after 1st August 1994 were not required to be manufactured to the EC standards requiring advanced emissions control system to be fitted. For these vehicles, the non-catalyst test should be applied.

Test Procedure

Visual inspection (all vehicles)

Once the preliminary checks have been completed, the tester will raise the engine speed to around 2500rpm or half the maximum engine speed if this is lower. The engine speed will be held steady for about 20 seconds then the engine will be allowed to return to this natural idle speed. Once the emissions have stabilised the tester will assess the smoke emitted from the tailpipe. If the exhaust is emitting dense blue or clearly visible black smoke then the vehicle will fail the test. In exceptional cases, especially on certain vehicles manufactured before 1960, emissions of smoke are unavoidable due to the engine design and, consequently, these vehicles will not fail the test.

Standard Emissions Test

For vehicles first used on or after 1st August 1975, emission will also be checked using an approved analyser. After completing the visual test, the tester will use the analyser to assess the concentration of carbon monoxide (CO) and hydrocarbons (HC) in the exhaust gases by inserting a sample prove into the exhaust tailpipe. The test is carried with the engine at its normal idling speed and the analyser displays the results continuously. Once a stabilised figure is achieved the tester will record the result.

Basic Emissions Test Procedure

This test will be applied to all petrol-fuelled vehicles first used on or after 1st August 1992. For cars subject to this procedure, the emissions are assessed during two separates tests. The first test consist of checking the emissions at "high idle" which involves running the engine at the speed 2500-3000 rpm. During this high idle test the emissions of CO and HC will be checked and further check will be made on the Lambda value. The second test consist of a "natural idle" test in which the engine will idle naturally between 450 and 1500rpm, but for these vehicles only the CO emissions are assessed. The emissions limits are specified for both the high and low idle tests. At high idle CO <+0.3%, HC<+200ppm, and the lambda value will be between 0.97 and 1.03. At natural idle CO<0.5%.

Where a failure is recorded during any element of the test, and then the analyser will automatically schedule an extended emission test according to Table 1 or Table 2 and the listings in the Annex in this booklet.

Extended emissions test (e.g. vehicles with catalytic convertors).

This test applies to all petrol-fuelled cars fitted with advanced emissions control system and which were first used on or after 1st August 1995, and to some petrol-fuelled cars first used on or after 1st August 1992. The procedure is described below.

"Catalyst" test procedure

For car subject to this procedure, the emissions are assessed during two separate tests. The first test consist of checking the emissions at "high idle" which involves running the engine at the speed specified in the Annex to this publication, typically 2500-3000rpm. During this high idle test the emissions of CO and HC will be checked and a further check will be made on the Lambda value (which is defined in Tables 5 & 6). The second test consists of the standard "idle" test as described above but for these vehicles only the CO emissions are assessed.

Before starting the emissions test, the tester will check the engine oil temperature to ensure that the engine is at the manufactures stated operating temperature. This will require a temperature probe to be inserted into the dipstick tube. Once the preliminary checks have been carried out and the tester has identified the vehicles model then the tester will begin the high idle emissions test.

Once the engine speed has stabilised between the upper and lower limits, the emissions will be measured for a continuos 30 seconds period. At end of this period, the analyser will automatically compare the results of the test with those specified in the book on inuse vehicle emission standards. Provided the results are equal to or below the specified limits, the vehicle will have passed this section of the test and the analyser will automatically proceed to the normal idle test. The normal idle test is the same as that described above for conventional petrol engined vehicles although the check for HC is omitted. In the event of the vehicle failing the high idle test but passing the low idle test, the analyser will automatically sequence a period of "pre-conditioning" followed by a further emissions test. The vehicle must pass through the high and the normal idle emissions tests to secure a pass result.

Diesel Engined vehicles

All Private cars and light goods vehicles (<3500 GVW)

Visual Inspection

For vehicles first used before 1st August 1979, a visual test will be carried out. The tester will check the smoke emissions by raising the engine speed to around 2500rpm or half the maximum engine stabilised for 20 seconds, the tester will then allow the engine to return to idle. After letting the engine stabilise at this speed, the tester will assess the emissions from the exhaust tailpipe. If the exhaust is emitting dense blue or clearly visible black smoke for a period of 5 seconds or more then the vehicle will fail the test. However, vehicles manufactured before 1960, will not be failed if the smoke is unavoidable due to the engine design.

Metered smoke test

For vehicles first used on or after 1st August 1979, a metered smoke test will be carried out. Before checking the smoke emission the tester will first ensure that the engine speed governor is functioning by increasing the engine speed to around 2500rpm or half the maximum engine speed if this is lower. Upon reaching this speed, the tester will hold the engine speed steady for 20 seconds then the engine speed will be slowly increased to check the operation of the fuel pump governor. Where the engine speed stabilises at its maximum speed, indicating the at the governor is working, the engine will then be returned to idle speed, indicating that the governor is working, the engine will then be returned to idle speed and stopped, the smoke test will not be carried out – and the tester will be unable to pass the vehicle. Having re-started the engine the tester will start the smoke test. The smoke meter will indicate to the tester when to accelerate the engine and after 2 seconds have elapsed it will display a message telling the tester to release the throttle. The meter will calculate the maximum smoke emissions during the acceleration and display the results. A further two accelerations will be requested by the meter. Provided the average of the 3tests is on or below the appropriate limit in Table 7, and the three results are within a certain tolerance of each other, then the vehicles will have passed the test. The tester will stop the engine and remove the smoke meter probe from the tailpipe.

Where the average smoke emission at the end of the third acceleration exceeds the limit in Table 7 then the meter will request further tests until either the average of the three preceding accelerations is on or below the limit in the Table or a maximum of six accelerations have been completed. In either case the tester will stop the test and remove the probe from the exhaust tailpipe.

As a final check the tester will assess visually whether the smoke emitted from the exhaust, regardless of measured smoke density is likely to obscure the vision of other road users. If it is likely to do so, in the tester opinion, then the vehicle will fail the test.

All heavy goods vehicles and large passenger vehicles.

The tester will first purge the engine by increasing the engine speed to just below the maximum governed speed. Once this speed is reached the engine will be held at this stabllisised speed for 30 seconds then the engine will be returned to idle speed and stopped.

Having restarted the engine, the tester will start the smoke test and await the signal from the smoke meter to accelerate the engine. Having accelerated the engine from idle to maximum governed speed, the meter will next instruct the tester to release the throttle. As the engine returns to idle speed, the meter will calculate the maximum smoke emission during the acceleration and display the value. The meter will then automatically schedule three further tests and providing the average smoke level of the four tests is on or below the limits specified in Table 7, and all the smoke results are within a specified tolerance, then the vehicle will have passed the test. At this point, the tester will stop the engine and remove the smoke meter probe from the tailpipe.

Where the average smoke emission at the end of the fourth acceleration exceeds the limit Table 7 then the meter will request further tests until either the average of the four preceding accelerations is on or below the limit in the table (and the results are within a certain tolerance of each other), or a maximum of ten accelerations have been completed then the tester will stop the engine and remove the smoke meter probe from the tailpipe.

As the final check the tester will assess visually whether the smoke emitted from the exhaust, regardless of measured smoke density is likely to obscure the vision of other road users. If it is likely to do so, in the tester opinion, then the vehicle will fail the test.

Table 5 In use vehicle emission standards for petrol fuelled cars

LIMIT	**Maximum measured values at natural engine idle speed.**			**Maximum measured values at raised engine speed and with the gearbox in neutral.**			
Date of first use.[1]	Carbon Monoxide (CO)	Hydrocarbon (HC)[3]	Engine idle speed (rpm)	Carbon Monoxide (CO)	Hydrocarbon (HC)	Lambda[2]	Engin spee (rpm)
Before 1/8/75	No requirement	No requirement	No requirement	No requirement	No requirement	No requirement	No requi ment
From 1/8/75 and before 1/8/86	4.5% vol	0.12% vol (1200ppm)[4]	No specific requirement but engine must be clearly above its normal idling speed.	No requirement	No requirement	No requirement	No requi ment
From 1/8/86 and before 1/8/92	3.5% vol	0.12% vol (1200ppm)	No specific requirement but engine must be clearly above its normal idling	No requirement	No requirement	No requirement	No requir ment

LIMIT	Maximum measured values at natural engine idle speed.			Maximum measured values at raised engine speed and with the gearbox in neutral.			
			speed.				
From 1/8/92 and before 1/8/94 but are not included in the Annex	3.5% vol	0.12% vol (1200ppm)	No specific requirement but engine must be clearly above its normal idling speed.	No requirement	No requirement	No requirement	No requirement
From 1/8/95[5] but are not included in the Annex	0.5% vol	No requirement	No specific requirement but engine should be at its normal idling speed.	0.3%	0.02%vol (200ppm)	1±0.03	>2500 rpm <3000 rpm
From 1/8/92 and that are included in the Annex	As stated in the Annex	No requirement	As stated in the Annex	As stated in the Annex	As stated in the Annex	As stated in the Annex	As stated in the Annex

Notes

1. Date of first use is as defined in Regulation 3(3) of the UK Road Vehicle (Construction and Use) Regulations.
2. Lambda is the ratio of the mass of air/mass of fuel divided by 14.7.
3. HC is normally measured during the natural idle test. However, where a vehicle meets the CO limit but exceeds the HC limit at this speed, the tester must carry out a further test at 2000rpm. Provided the HC limit is met at this higher speed then the vehicle meets the requirement.
4. PPM refers to 'parts per million' which is how MOT meters display the result.
5. Passenger cars first used before 1 August 1995 and not mentioned in the Annex are tested to non-catalyst standards.

Table 6 In use vehicle emission standards for other petrol fuelled cars

LIMIT	**Maximum measured values at natural engine idle speed.**			**Maximum measured values at raised engine speed and with th gearbox in neutral.**			
Date of first use.[1]	Carbon Monoxide (CO)	Hydrocarbon (HC)[3]	Engine idle speed (rpm)	Carbon Monoxide (CO)	Hydrocarbon (HC)	Lambda[2]	Engine speed (rp
Before 1/8/75	No requirement	No requirement	No requirement	No requirement	No requirement	No requirement	No requireme
From 1/8/75 and before 1/8/86	4.5% vol.	0.12% vol. (1200ppm) [4]	No specific requirement but engine must be clearly above its normal idling speed.	No requirement	No requirement	No requirement	No requireme
From 1/8/86 and before 1/8/94	3.5% vol	0.12% vol (1200ppm)	No specific requirement but engine must not be clearly above its normal idling speed.	No requirement	No requirement	No requirement	No requireme
From 1/8/94 but not included in the Annex	3.5% vol	0.12% vol (1200ppm)	No specific requirement but engine must not be clearly above its normal idling speed.	No requirement	No requirement	No requirement	No requireme
From 1/8/94 and included in the Annex	As stated in the Annex	No requirement	As stated in the Annex	As stated in the Annex	As stated in the Annex	As stated in the Annex	As stated i the Annex

Notes

1. Date of first use is as defined in Regulation 3(3) of the UK Road Vehicle (Construction and Use) Regulations.
2. Lambda is the ratio of the mass of air/mass of fuel divided by 14.7.

3. HC is normally measured during the natural idle test. However, where a vehicle meets the CO limit but exceeds the HC limit at this speed, the tester must carry out a further test at 2000rpm. Provided the HC limit is met at this higher speed then the vehicle meets the requirement.
4. PPM refers to 'parts per million' which is how MOT meters display the result.

Table 7 In use vehicle emission standards for all Diesel fuelled cars

LIMIT	**Maximum smoke value (absorption coefficient measured under free accleration)**	
Vehicle type	Turbocharged engines	Naturally aspirated engines
Passenger cars and light commercial vehicles (<3,500kg) and first used[1] before 1 August 1979	Visual assessment	Visual assessment
All other vehicles	3.0 per metre	2.5 per metre

Notes

1. Date of first use is as defined in Regulation 3(3) of the UK Road Vehicle (Construction and Use) Regulations.

D

I&M Test procedures for emission checking world-wide

I/M short tests (idle/two-speed idle)

General methodology

I&M short tests include all tests during which no external load is exerted and the vehicle operates with the transmission in neutral position. The test involves CO, HC and eventually CO2 concentration measurement in the raw exhaust gas at idle speed and / or at high engine speed. The test could last from less than 1 minute (in case of 1 speed idle test without preconditioning) to about 10 minutes (in the case of a 2-speed test with a second chance test including preconditioning).

Test instrumentation

A garage type non-dispersive infrared (NDIR) analyser capable of measuring CO, HC and CO2 concentration is sufficient.

Advantages

Today, these tests are very widely used in the I&M programmes because they are faster, cheaper and easier to perform with the minimum testing equipment.
For catalyst or catalytic converter equipped cars, a lambda test may be coupled with the idle test in order to check the performance of the closed loop system.
For carburetted vehicles these tests could effectively identify malfunction mixture preparation systems by checking the performance of carburettors idle mixture orifice in the idle test and the main fuel-metering orifice in the high idle test.

Disadvantages

However, modern cars equipped with the electronic fuel injection and ignition system with 3-way catalyst may have a defect that cannot be detected through their pollutant emissions at idle even worse the great bulk of emissions may be generated during the transient engine operation. An additional drawback is the negligible amount of NOx emissions at idle, which may be very high during the loaded conditions.

Short tests in detail

EPA has promulgated rules for six steady-state performance warranty procedures (I to VI) available for use in I/M programmes. These are described below:

Idle test – this test consists of a 90 second idle (350-1100 RPM) emission sampling period and includes a second change test with pre-conditioning at 2500 RPM if the vehicle fails at the first test. Pass/fail determination is based on a 5 second running average emission sample.

Two Speed Idle Tests - This test consists of a 90 second idle emission sampling period followed by a 90 second 2500-RPM emission sampling period. A second chance test starting immediately with the 2500-RPM emission-sampling period is included. Pass/fail determination is based on a 5 second running average emission sample.

Loaded Test - This test consists of a 90 second emission sampling period with the dynamometer held at a steady speed (test speed and loading vary by engine displacement) followed by a 90 second idle emission sampling period. Pass/fail determination is based on a 5 second running average emission sample.

Pre-condition Idle Test - This test contains a 30-second pre-conditioning period at 2500 RPM followed by a 90-second idle emission-sampling period. A second chance test consists of 180 second at 2500 RPM followed by 90-second idle emission sampling period. Pass/fail determination is based on a 5 second running average emission sample.

Idle test with loaded pre-conditioning - consists of a 90-second idle emission-sampling period. If the vehicles fails a second chance test consisting of a 30 second preconditioning period at 2500 RPM followed by another 90-second idle emission sampling period is conducted. Pass/fail determination is based on a 5 second running average emission sample.

Pre-conditioned To Speed Idle Test – consists of a 90 second 2500-RPM emission sampling period followed by 90-second idle emission sampling period. If the vehicle fails a second chance test consisting of a 180 second 2500-RPM emission sampling period followed by a 180 second idle emission sampling period is conducted. Pass/fail determination is based on a 5 second running average emission sample.

Standard Emission Test in Europe- Before carrying out the test the tester confirms that the engine is at its normal operating temperature that, in some cases, will require the use of a temperature probe inserted into the dipstick tube. Before proceeding, the tester will also check that the engine has adequate oil & fuel to complete the test. The vehicle is kept in the neutral && at normal idling speed. The analyser is used to assess the concentration of carbon monoxide & hydrocarbons in the exhaust by inserting the sample probe in the exhaust tailpipe. Once a stabilised figure is achieved, the tester will record the result. The pass/ fail criteria are defined in % or PPM concentration.

*Extended Emissions Test in Europe-*This test applies to the spark ignition vehicles fitted with advanced emission control systems.

Catalyst test procedure

For cars and other spark ignition vehicles subjected to this procedure, the emissions are assessed during two separate tests. The first test check consists of checking the emissions at 'high idle', which involves running the engine typically at 2500 to 3000 rpm speed. During this high idle test, the emissions of carbon monoxide and hydrocarbons are checked and a further check is carried out on the lambda value. The second test consists of a standard idle test as described above, but for these vehicles only CO emissions are assessed.

Separate emission limits are specified for both the high and low idle tests. But as the extended emission test is more complicated that the standard test, the emission analyser s are designed to a more stringent standard and include computer software aimed at guiding the tester through the test sequence. The primary reason for introduction of these meters is to ensure that the car is tested accurately and a fair result is recorded. The analyser will require the tester to complete each stage of the test before proceeding to the next. In addition where a failure is recorded during the high idle test, then the analyser will automatically schedule a repeat test. This is to ensure as far as practicable that the catalytic converter has reached its normal operating temperature.

The test requires the engine speed to be increased to the specified speed. Once the engine speed has stabilised between the upper and lower limits, the emissions will be measured for a continuous 30 seconds period. At the end of this period, the analyser will automatically compare the results of the test, with the limits. Provided the test results are equal to or below the specified limits the vehicle passes the section of the test and the analyser will automatically proceed to the normal idle test.

In the event of the vehicle failing the high idle test, but passing the low idle test, the analyser will automatically sequence a period of pre-conditioning followed by a further emission test. The vehicle must pass both high and normal idle emission tests to secure a pass result.

Acceleration simulation mode (ASM) test

General methodology

This is a steady state loaded test. This test involves a dynamometer with steady state power absorption. A simulation of vehicle inertia mass is not required because there is no transient phase in the emission test. The car is driven at a constant speed and load and pollutant concentrations of CO, HC, NOx and CO2 are measured during the load phase.

Test instrumentation

A fixed load type chassis dynamometer without vehicle inertia simulation along with the raw emission measurement system. The raw emission measurement system consists of NDIR type CO, HC & CO2 analyser and the NOx analyzer either electrochemical type or chemiluminescense type.

Advantages

As the NOx emissions at no load conditions are negligible, a loaded test is therefore necessary in order to measure NOx emission levels, which constitute a critical factor in urban air pollution.

Simpler & cheaper as compared to transient tests like IM-240.

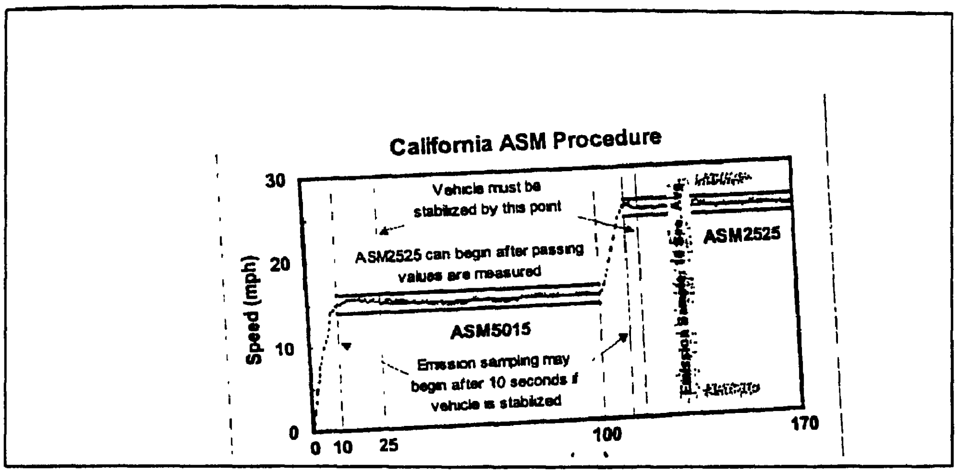
Disadvantages

However, the implementation is limited during owing to the high cost of the dynamometer and NOx analyser.

Loaded test details

The ASM test is a loaded mode steady state consisting of two modes: the ASM5015 and the ASM2525. Depending on the particular I/M programme, the actual ASM test used may consist of either one of the two modes, or both modes. The first two numbers of the ASM mode correspond to the vehicle dynamometer-loading factor (explained below) and the last two numbers correspond to the vehicle test speed. Undiluted emissions (raw) are measured using less expensive analysers that the IM240 or FTP (NDIR for HC). ASM testing is used in several I/M programmes including British Columbia since 1992.

Dynamometer loading for the ASM test is prescribed as a percentage (50 % for ASM 5015 and 25 % forASM2525) of the load required to accelerate at 3.3 mph/sec (the maximum acceleration rate during the FTP). Loading for an 8.65" twin-roll dynamometer is calculated using the following two equations.



HP_{5015} = ETW/250

HP_{2525} = ETW/300.

Loading for a different size or configuration of dynamometer is calculated using more complex equations. In a similar manner to the IM240 grouping, ETW is established for a subset of vehicles based on the model year, model, engine displacement and transmission. The following chart is a sample speed/time test for the ASM test performed in California.

Pass/fail determination is based on a 10 second moving average concentration measurement of each constituent. Once a set of passing values is measured, the particular test mode being conducted is complete.

IM240

General Methodology

IM240 is a highly automated test that involves only minimal inspector discretion. The process begins by driving the vehicle on to the dynamometer, activating vehicle restraints properly placing the exhaust collection device and positioning the engine-cooling fan. The tester then drives the vehicle according to a prescribed cycle displayed on a video screen. The tester follows the driving cycle using the accelerator pedal and brake to speed up and slow down just as a vehicle is being driven on a city street. A cursor on the video screen indicates the vehicle speed. The tester adjusts the speed to keep the cursor on the trace. This technique is easily learned by anyone who can drive a car. If the tester fails to follow the driving trace properly, the test is aborted and restarted although this is rarely a problem.

The length of IM240 test varies depending on the vehicle emissions. To determine emission levels second by second emission measurements are taken. The test computer continuously monitors the emission levels during the test and as soon as the emission rates indicate that the vehicle is exceptionally clean the computer automatically notifies the tester to stop the testing. This may occur within 30 seconds also. For vehicles that are over or close to the maximum permissible emission levels the test may continue for a full of 240 seconds. Thus, while the complete driving cycle is 240 seconds long, the average test time will be about 2 minutes.

The emission standards used in the IM240 test are expressed in terms of g/km rather than a percentage or parts per million as in the case of steady state tests. Different standards are set for each model year and reflect the technology that was in effect at the time of manufacture. The standards are typically two to three times higher than new emission certification standards for that model year.

Test instrumentation

The equipment needed to perform the IM240 is different from the equipment used for either the idle-type I/M test or the single-speed dynamometer tests used in some states (e.g., Arizona and Florida). These differences include dynamometer capabilities, video driver trace monitors, special sampling systems, and emission analysers. In addition, the high-tech test system will use computer controls with integrated quality assurance functions, and will be completely automated.

The primary difference between the dynamometer used for the IM240 and that used for single speed I/M tests is the addition of inertia flywheels. The inertia flywheels used are based on the weight of the car being tested. They allow the inspection test to simulate vehicle acceleration and deceleration by putting a load on the engine. This in turn allows the measurement of emissions under these normal-driving conditions. This type of dynamometer is widely available and is similar to the ones used by EPA and car manufacturers for new car certification.

Computer will automatically determine the selection of the inertia weight and test horsepower for an individual vehicle so that the I/M inspector is only required to drive the vehicle onto the dynamometer. Even the system used to hold the vehicle on the dynamometer will be automatic in order to minimise tests set-up time and improve testing efficiency.

The vehicle's mass emissions are determined by collecting the entire exhaust flow from the tailpipe with a device known as a Constant Volume Sampler (CVS). The CVS dilutes the exhaust with fresh air and measures the flow rate of the mixture. Mass emissions (for each second) are calculated by multiplying this flow rate by the measured concentration of pollutants in the mixture. To arrive at the official test value in grams per mile, the mass emissions for each second are added together; this sum is then divided by the distance (number of miles) travelled over the 240-second test cycle.

The fresh air dilution is vital because it preserves the integrity of the sample and because it protects the emission analysers from high concentrations of water vapour produced by the vehicle. The dilution process also allows the measurement system to accommodate the differences in exhaust flow between small engines and large engines while measuring the true amount of emissions from each type of engine.

The dilute sample, however, lowers the concentration of pollutants to be measured, and hence requires more sensitive emission analyzers than those used by traditional I/M programs. In addition, the method for measuring HC emission uses a different and more accurate technique than traditional programs. HC emissions are measured with a Flame Ionization Detector (FID), while CO and carbon dioxide emissions are measured using non-dispersive infrared analyzers. NOx emissions are measured with a chemiluminescense analyzer.

Advantages

The IM240 differs from traditional I/M tests in that the emissions are measured while the vehicle is driven on a treadmill-like device called a dynamometer. The dynamometer is a moving road n the lab. Most I/M tests today are conducted while the vehicle is idling. A few states test vehicles on a dynamometer, but only operate the vehicle at one speed.

In the IM240, the vehicle is operated over a driving cycle that has many different speeds. The cycle is designed to resemble typical city driving and includes driving modes such as acceleration and deceleration. Vehicle acceleration and deceleration can be significant sources of emissions from malfunctioning vehicles.

Hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) emissions are all measured during the IM240, while only HC and CO emissions are measured in traditional I/M tests. HC and NOx emissions combine in the atmosphere to form ground-level ozone, the primary component of smog. Another important difference between the IM240 and traditional I/M tests is the way emissions are measured. The IM240 captures the entire exhaust stream during the test and measures the total mass of emissions from the vehicle (grams of pollutant per mile driven). Traditional tests measure the concentration of pollutants in exhaust (percent or PPM). Mass emissions are a more accurate way of measuring the emission performance of large and small engines and are more directly related to the contribution that each car makes to air pollution. The IM240 also can measure fuel economy.

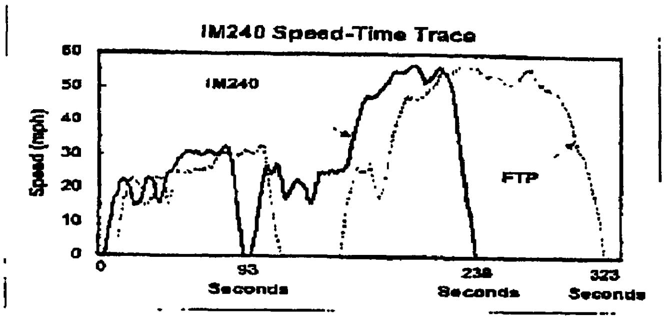
IM 240 test is very similar to the certification testing carried out for the vehicle emission. (Federal Test Procedure i.e. FTP in United States)

Disadvantages

The test instrumentation is very costly because it uses the dynamometer, emission system & CVS system for the measurement of the mass emissions like certification procedure.

IM 240 Test Details

The IM240 test is a loaded mode transient test that is very similar to the first two hills of Bag 3 of the FTP (see the following chart). It has been used in several states including Arizona and Colorado since 1995. The IM240 test utilises an exhaust analysis system that is very similar to that used in the FTP (CVS, FID, Chemilumnescent Analyser etc)



Pass/fail determination for a given constituent is based on a gram/mile measurement over the entire test. Additionally, pass/fail determination for a given constituent may be based on a gram/mile measurement over Phase 2 (second 94 through second 239) of the IM240. Finally, several states incorporate a fast pass methodology in order to each pollutant in each second (on a total gram basis), and comparing them to cumulative emissions fast-pass standards for each pollutant for the second of the test under consideration. If a vehicle's cumulative emissions are below a given level for all pollutants, the vehicle passes the test. Fast-pass standards and methodologies vary by state I/M programme and can be complex; however, they are typically based on the same emission standards listed in EPA Final IM240 Standards on pages 13-15.

Similar to the FTP, dynamometer loading for the IM240 is based on ETW and HP (horsepower setting). Because it is not feasible to establish ETW and HP settings for each individual vehicle that is tested, ETW and HP are incorporated for a group of vehicles. Vehicles are typically grouped by model year, model, engine displacement and transmission.

31

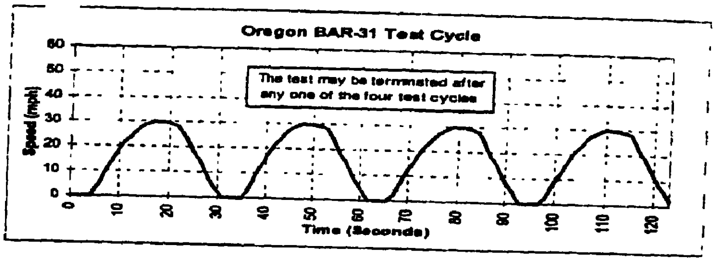
The Bar 31 test was developed by California Bureau of Automotive Repair (BAR) and was intended to be used as a diagnostic tool for vehicle repair. However, several States have shown in interest in using the test as the official test for their I&M. To date, Oregon has adopted the BAR 31-test procedure and Davis country Utah has implemented a DC-98 test (which is similar to BAR 31 test).

The Oregon test cycle consists of a single 31-second symmetrical peak with a maximum speed of 30.1 mph. If the vehicle exceeds the emission standards measured in g/mile, additional cycles up to a maximum of 4 will be driven.

If the vehicle passes the Standards during any of the four cycles, the test will be terminated. If after four cycles, the vehicle still has not passed the test and algorithm is used extrapolate the emission readings through a sixth testing cycl If the algorithm shows the vehicle meets the Standards in the hypothetical sixth cycle the vehicle will pass the emission test.

The algorithm consists of extrapolating the emission readings linearly from the first four cycles to the hypothetical sixth cycle using a list square regression line.

The following chart depicts the Oregon test cycle.



RG-240

The RG-240 test is similar to IM240 test (the same test cycle used for both tests). The predominant difference is that the test equipment used for RG240 test is designed for use in repair shop – the 'RG' stands for 'repair grade'. Because the cost of the test equipment is an important consideration, when States develop their I&M programme, RG-240 provides an attractive low cost alternative to IM240.

Cost for the RG-240 is reduced by using a simpler dynamometer (limited inertia weight capability) and BAR90 emission gas analyzer.

The IM240 uses a flame ionisation detector (FID) to measure HC. A non-dispersive infra red (NDIR) analyser for CO, and a chemiluminescense analyser for NOx. The RG-240 uses an NDIR for HC and CO and an Electro-chemical or repair grade chemiluminiscense analyser for NO. Additionally, the constant volume sampler (CVS) for RG-240 uses a critical flow venturi rated at approximately 100 SCFM, which is much lower capacity CVS than used for IM240 (700 SCFM).

IG-240

The IG-240 test is very similar to IM240 and RG-240 test (the same test cycle is used for this test). The predominant difference between the IG 240 and RG240 is that slightly better equipment is used for IG240 test. Dynamometers, analyzers and CVS more closely match that of IM240. 'IG' stands for inspection grade. Like RG240 test, IG240 allows States to reduce test equipment cost.

IM-93

IM93 consists of first 93 seconds of IM240 test. The I&M programme in Indiana is currently using this cycle. This is an attractive test cycle for some programmes because the maximum speed is less than 25 mph thereby, alleviating a vehicle owner's perception that testing at higher speeds may damage the vehicle. Another benefit is that the test is shorter thereby reducing overall test time. The test cycle may be repeated to alleviate concerns about vehicle pre-conditioning.

IM240Phase-2

This test cycle consists of last 147 seconds of the IM240 test. Typically the first 93 seconds of the IM240 test is performed as pre-conditioning. If a vehicle does not pass a test on the first try, the second chance test consists of only 140-second portion. (i.e. the first hill of IM240 is not repeated).

NY test

This test is similar to IG240 test with the exception that a VMAS technology is used to measure exhaust flow instead of CVS. VMAS is a patented technology that may potentially provide a low cost alternative to the standard CVS system. EPA is currently evaluating the viability of the VMAS technology.

Effectiveness of Evaporative Systems

Evaporative system purge test

The fuel tanks on vehicles are designed as a closed system in which vapours that evaporate from the gasoline in the tank are not released into the atmosphere. The system is sealed and under pressure so that excess vapours are shunted to a container filled with charcoal known as the evaporative canister.

The purge test is used to determine whether fuel vapours stored in the evaporate canister and present in the fuel tank are being drawn into the engine for combustion. If the purge system is not working properly the evaporative canister can become saturated and start to vent hydrocarbons into the atmosphere. In addition to causing HC emissions, failure of the purge system wastes gasoline and reduces fuel economy.

The purge test is conducted while the vehicle is undergoing the IM240 on the dynamometer. Purge flow is measured by simply inserting a flow meter at one end of the hose that runs between the evaporative canister and the engine. Determination of an acceptable purge rate is based on the total volume of flow through the system during the IM240. The vehicle must have a minimum of 1 litre of flow in order to pass. Most vehicles in proper working order will accumulate 25 litres or more during the IM240. As soon as a vehicle exceeds 1 litre of volume, the purge test is complete. The entire IM240 driving cycle ends as soon as final results are determined for the emission test.

The purge test requires a flow meter that can measure the total volume of flow over the transient cycle. Additionally, hoses and universal fittings are required to hook up the flow meter as indicated below. Finally, a computer is needed to control the test process, collect and record the data, and determine the pass/fail status.

Evaporative system pressure test

The pressure test checks the system for leaks that would allow fuel vapours to escape into the atmosphere. A pressure decay method is used to monitor for pressure loses in the system. In this method, the vapour lines to the fuel tank and the fuel tank itself are filled with nitrogen to a pressure of 14 inches of water (about 0.5 psi). Since the fuel system is designed to withstand pressures up to 50-60 inches of water, there is no danger of over-pressurizing the system. To pressurize these components, the inspector must locate the evaporate canister, remove the vapour line from the fuel tank, and hook up the pressure test equipment to the vapour line. The system is automatically filled with nitrogen using computer controls and hardware flow controls. The pressure supply system is closed off and the computer monitors any loss in pressure. If pressure in the system remains above eight inches of water, the vehicle passes the test.

A source of nitrogen, a pressure gauge, a valve and associated hoses and fittings are needed to perform the pressure test. In addition, a computer is used to automatically meter the nitrogen, monitor the pressure and collect and process the results. Algorithms are developed to optimise the test so that a pass/ fail decision can be made in less than two minutes on most vehicles.

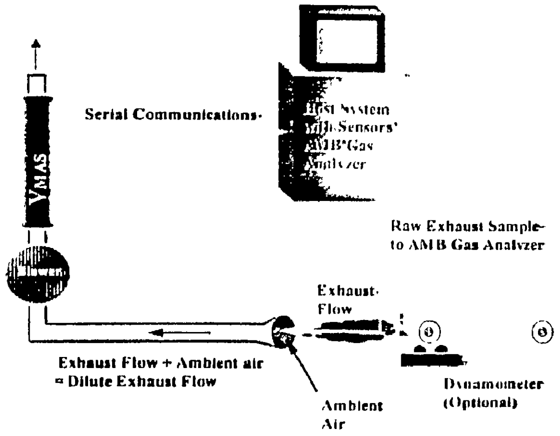
VMAS measurement technology

Vehicle mass analysis system: VMAS

It is a recent, innovative, low cost method for transient mass emission measurement. It can replace the CVS system required in the in IM 240 testing and still can give the same results in g/km or g/mile.

The following Figure shows a typical setup of VMAS measurement system.

Typical System with VMAS™


VMAS
Blower
Serial Communications
Host System With Sensors' AMB Gas Analyzer
Raw Exhaust Sample to AMB Gas Analyzer
Exhaust Flow
Exhaust Flow + Ambient air = Dilute Exhaust Flow
Ambient Air
Dynamometer (Optional)

It uses Oxygen dilution ratio to compute the exhaust flow.

Dilution Ratio = Exhaust flow rate/ Dilute flow rate

=(Ambient O2 –Dilute O2)/(Ambient O2-Raw O2)

Ambient as well as raw O2 are measured by zirconia based O2 sensor. Raw O2 is measured by gas analyser. It uses vortex flow meter to measure flow.

Advantages of the system:

- Cost Effective Performance
  - Operating as well as initial cost is very low as compared to the IM 240 system
  - Existing tests can be upgraded to the transient loaded tests
- Accurate
  - Co-relates very well with the IM240 including HC.
- Innovative
  - Integrated microprocessor & software
  - Performs fully compensated mass computations and relays results to host PC via serial link.

- Safe
  - No Hydrogen – Helium used in HC FID analyser.
  - No O3 produced in chemiluminence Nox analyser.
- Unique
  - Only low cost mass measurement system approved by regulatory agency
  - Being used in New York for I&M.
  - Can be used in decentralized I & M system

Role of remote sensing in I&M

What is remote sensing?

Remote sensing is a way to measure pollutant levels in a vehicle's exhaust while the vehicle is travelling down the road. Unlike most equipment used to measure vehicle emissions today, remote sensing devices (RSD) do not need to be physically connected to the vehicle. The concept of RSD as an efficient tool to monitor the vehicle fleet and identify excessive polluters has great appeal as a complement to traditional mobile source emission control programmes. A number of instrument manufacturers are actively developing RSD systems.

What pollutants are measured by RSD?

RSD systems can measure hydrocarbons, carbon monoxide and oxides of nitrogen in the exhaust stream. RSD cannot, however, measure "evaporative" emissions – gasoline vapours that vent into the air from hot engines and fuel systems. Fuel evaporation is very significant source of hydrocarbon pollution that can exceed tailpipe emissions on hot days.

How does remote sensing work?

Commercially, RSD systems employ an infrared absorption principle to measure HC and CO emissions. These systems operate by continuously projecting a beam of infrared radiation across a roadway. It is expected that RSD systems for NOx will use either a beam of ultraviolet light, or light from a tunable diode laser projected across the road.

As a vehicle passes through the RSD beam, the device measures the ratio of CO (and exhaust HC) to carbon dioxide (CO2) in front of the vehicle and in the exhaust plume behind. The system uses the "before" measurement a base and calculates the vehicle's CO emission rate by comparing the "behind" measurement to the expected ratio for ideal combustion. Exhaust HC is calculated in a somewhat similar manner by comparing the total carbon content of exhaust HC, CO and CO2 to the total carbon content of the gasoline the vehicle burns. The CO2: CO ratio determined by current RSD systems will still be needed to calculate NOx emissions.

RSD systems employ a freeze-frame video camera and equipment to digitize an image of the license plate number so that a computer can process it. This allows the computer to store emissions information for each monitored vehicle, based on the license plate number.

Methods to measure a vehicle's speed and acceleration as it passes through the infrared beam may also be used. This is important because the operating mode (e.g. Acceleration, cruise, etc.) can significantly affect the instantaneous emissions level from a vehicle. Some types of operation during an RSD test may be cause for invalidating a particular test.

Computerized diagnostic technologies may also play a role in future RSD systems. Vehicle onboard diagnostic systems are capable of identifying certain malfunctions in a vehicle's emission control system. The malfunctions could be reported to roadside RSD systems by a small electronic device on the vehicle called a radio frequency transponder. Similar transponder concepts have been used to time runners in marathons and transponder systems are being used to assess toll road fees in some areas.

Role of RSD in enhanced inspection and maintenance programmes

RSD with other "on-board" emission measurement methods can play an important part to reduce emissions from motor vehicles. Enhanced I&M programmes include on-road emission testing of a portion of the eligible vehicle fleet. RSD technology is expected to play a major role in these supplemental emission measurements.

- RSD will likely be used to identify vehicles with malfunctioning emission controls between scheduled I/M tests. Air quality benefits can result from early repair of vehicles that would otherwise not be identified or repaired until the next annual or biennial test.
- Properly repaired vehicles maintain low emissions for a long time. However, some individuals may tamper with their vehicle's emission control systems. The mobility of RSD provides a way to identify tampered vehicles between periodic I&M tests and a way to enforce repair requirements on those vehicles found to be dirty.
- RSD can detect unregistered or improperly registered vehicles. This will allow authorities to pick out drivers who cheat on registration or register out of the area to avoid participating in an I&M programme.

- To take advantage of RSD's potential to identify dirty cars, EPA is requiring enhanced I&M programmes to conduct supplemental emission measurements on at least 0.5 % of vehicles subject to I&M testing each year. Vehicles that fail an RSD test would be required to be retested by the regular I&M test. Repairs would be required for any vehicle failing this out of schedule I&M emissions check.
- RSD can be only used as the supplementary to the enhanced I &M programmes to find out gross pollutants.

Implementing RSD in I&M programmes

There are a number of administrative factors to consider in establishing I&M programmes that include RSD. Some RSD advocates have suggested that RSD is capable of monitoring much more than 0.5 % of the fleet. RSD could be used by the I&M programmes to measure emissions from more cars, given adequate resolution of the following issues:

Placement of roadside monitors

Current RSD technology can only measure emissions of vehicles driving in a single lane of traffic. It is not easy to find enough sites where appropriate single traffic lanes exist to monitor the majority of vehicles subject to I&M testing. Restricting multiple lanes to a single lane for RSD measurement may not be practical in many cases, particularly during times of heavy traffic such as rush hour. Yet RSD testing during peak traffic periods would probably be necessary to avoid missing high-emitting vehicles that could be parked during business hours.

Another issue involves limiting RSD placement to locations where representative vehicle operation will be observed. It will be important for I&M programmes to avoid creating situations where a measurable portion of vehicles fails RSD monitoring at one location but pass at another location. For example, sites of high acceleration would likely be avoided because emissions tend to be higher during acceleration than during steady-speed driving.

Appropriate pass/fail levels

A difficult issue involves selecting an emission standard (cutpoint) for the RSD that will identify vehicles that need repair while minimizing false failures.

Notification

Administrative systems need to be established so authorities can follow up with owners of vehicles that register high emissions during an RSD check. Whether vehicle owners are pulled over immediately at the time of the check or notified later by mail, oversight will be necessary to ensure that dirty vehicles undergo further testing and repair, if necessary.

Driver behaviour

To date, RSD emissions testing has occurred only in demonstration type projects with no consequences for driver's whole vehicles fail the test. In the future, RSD failures in enhanced I&M programmes will result in mandatory retesting and repair. These consequences may prompt drivers to change their driving route or region (e.g. observing RSD testing in the opposite lane on the way to work, and choosing a different route home), or otherwise alter their driving behaviour to avoid passing an RSD monitor. The political implications of failing motorists, especially falsely, with this type of programme may be a significant problem.

Onboard diagnostic system checks as part of a vehicle inspection & maintenance program

An on-board diagnostic (OBD) system consists of a computer incorporated in a vehicle's electronics for the purpose of detecting operational malfunctions within the engine control system. When malfunctions are detected, a warning illuminates on the instrument panel and a 'trouble code' is stored in the computer memory identifying the part of the system (i.e. catalyst, oxygen sensor etc) in which the fault has occurred.

OBD systems are seen as a compliment to traditional I&M programmes rather than a substitute.

OBD in the USA

A final federal rule has been established, which requires manufacturers to install OBD systems on light duty vehicles and light duty trucks beginning with the 1994 model year. The thresholds are defined in FTP for OBD system identification of emission related malfunction or deterioration.

1. Emission related components : before it results in defined exhaust emission increase or results in leakage or other malfunction of the vapour recovery or purge systems that result in an evaporative emission increase defined level.

2. Catalyst deterioration before it results in a defined level of exhaust emission increase.
3. Engine mis-fire : before it results in a defined level of exhaust emission level increase.
4. Oxygen sensor deterioration : before it results in defined level of exhaust emission level increase.

In addition to detecting misfire, the system must also identify which cylinders are misfiring and if any other emission related powertrain systems or components have caused an exhaust emission increase. The OBD system must also detect the occurrence of any leakage or malfunction of the vapour recovery systems that result in an evaporate emission increase upto defined level for LDVs and LDTs. The diesel OBD only requires monitoring of catalyst malfunction o deterioration of other emission related power train components.

Calfornia

Whereas the EPAs enforcement strategy is based on in-use testing as a means of achieving the aim of reducing emissions from cars in use, the CARB approach is to place the emphasis of pre-production vehicle testing and on specifying the standard of the OBD system itself.

The original OBD regulation specified monitoring requirements for the oxygen sensor, EGR system and other emissions related components. In July 1990 the CARB adopted regulations, the so-called OBD II regulations, which required 1994 and subsequent model passenger cars, light duty trucks and medium duty vehicles and engines to be fitted with on-board diagnostic systems to monitor catalyst efficiency, engine misfire, evaporative system integrity, secondary air injection and chlorofluorocarbon (CFC) containment. These requirements were amended in 1991, 1993 and more extensively in 1995. These amendments allow manufacturers to take advantage of advances in technology in meeting the requirements and to take advantage of advances in technology in meeting the requirements and to allow more time to address the problems associated with low emissions vehicles and vehicles with engines using diesel fuel, alternative fuels or with lean-burn combustion systems. The OBD II requirements are described in more detail below.

The regulations apply to all passenger cars, light duty trucks and medium duty vehicles or engines and the system must incorporate the features given below for the various vehicle and engine types.

E Safety checking world wide experience

The list of items for safety checks that are commonly checked in most of the countries where safety checks are also the part of the inspection and maintenance program like Japan, Singapore and UK are given in table 1 below:

Table 1: List of items for safety checks

Sr. No	Item	Check Fit-ment	Check make / type	Check conditions	Check functioning	Test	Remark	Equipment required
1.	Lighting Equipment							
	Front, rear position lamps, Rear Registration Plate Lamps, Rear Fog Lamps	✓	-	✓	✓	-		
	Head Lamps	✓	✓	✓	✓	✓		Head lamp tester to test beam pattern and intensity.
	Stop Lamps	✓	-	✓	✓			
	Rear reflectors	✓	-	✓	-	-		
	Direction Indicators & Hazard Warning Devices	✓	-	✓	✓	✓	Check for driver tell-tale Flashing rate within 60 to 120 per minute	-
2.	Steering & Suspension							

Sr. No	Item	Check Fit-ment	Check make / type	Check conditions	Check functioning	Test	Remark	Equipment required
	Steering control and system	-	-	✓	-	-	Check for free play, play under load, lock to lock check, steering column check	
	Power steering	-	-	✓	✓	-	-	
	Suspension general	-	-	✓	-	-	-	
	Front suspension, front wheel bearing and drive shafts	-	-	✓	-	✓	-	-
	Rear suspension, rear wheel bearings	-	-	✓	-	✓	-	-
	Shock absorbers	✓	-	✓		-	-	
3.	Brakes							
	Parking brake and hand operated brake	✓	-	✓	✓	-		
	Service brake control and its component	✓	-	✓	✓	✓	Brake efficiency is calculated from the	Roller and plate brake testers and decelerometers for brake

Sr. No	Item	Check Fit-ment	Check make / type	Check conditions	Check functioning	Test	Remark	Equipment required
	s						test.	efficiency testing
	Antilock braking system	-	-	-	✓	-	Fault indication lamp is verified.	
4.	Tyres and Roadwheels	-	✓	✓	-	✓	Tyre breadth of tread is verified.	Tyre tread depth gauge
5.	Seatbelts	✓	-	✓	✓	-	-	
6.	General items							
	Driver's view of the road including vipers, washers, windscreen	✓	-	✓	✓	-	-	
	Horn	-	-	-	✓	-	-	ı
	Exhaust system	-	-	✓	-	-	-	
	General condition of the vehicle, which includes doors, load security, seats, obligatory mirrors, fuel caps, fuel line etc.	✓	-	✓	-	-	-	
	Registration	✓	-	✓	-	-	-	

Sr. No	Item	Check Fit-ment	Check make / type	Check conditions	Check functioning	Test	Remark	Equipment required
	plates and vehicle identification number							

F

Proposed safety checks for India

Table 1: List of proposed safety items to be checked in India

Items to be inspected	Procedure for inspection	Reasons for Rejection
1. Brakes		
(A) Service Brake		
(i) Mechanical conditions	Carry out a visual inspection of the components of the vehicle on a pit or hoist while the brake is eventually operated with a pedal-presser. Note: Vehicles with power brakes should be inspected with the engine switched off.	(a) Any fractures, deformation or badly corroded parts (b) Any excessive wear in pivots or absence of properly locked connectors. (c) Any obstruction to free movement (d) Any leaks in or damage hydraulic / air / vaccum pipes or reservoirs (e) Loose attachment of components. (f) Insufficient reserve travel of operating pedal. (g) Incorrect operation of pressure vacuum warning device. (h) Damaged or inoperative light/laden valves. (i) Defect light indicator.
(ii) Efficiency	Carry out the test with a static brake testing machine or at a road test using either an indicating or recording decelro-meter. It is preferable for goods vehicles to be laden for this test. If, however, the vehicle is not laden: (a) For air brakes measure the braking effort up to point of wheel slip and extrapolate to obtain indication of braking effort applicable when vehicle is laden; (b) For hydraulic brakes measure the braking effort at pedal pressure up to point of wheel slip	(a) The brake does not give at least the minimum figure laid down in the Regulations.

Items to be inspected	Procedure for inspection	Reasons for Rejection
	and extrapolate to obtain braking effort for laden vehicle.	
(iii) Balance	Carry out a road test with a decelerometer or a test on a static brake test machine.	(a) If a decelerometer test is used the vehicle swerves to one side when the brakes are applied. (b) If a brake test machine is used the brake effort from one wheel is significantly below that of the other wheel on the same axle
(B) Emergency Brake		
(i) Mechanical Conditions	Carry out a visual inspection of the components. Note: If the emergency brake is part of the service brake it may not be possible to carry out this test separately.	(a) Any fractures, deformation or badly corroded parts (b) Any excessive wear in pivots or absence of properly locked connectors. (c) Any obstruction to free movement (d) Any leaks in or damage to hydraulic/air/vacuum pipes or reservoirs (e) Loose attachment of components. (f) Insufficient reserve travel of operating pedal. (g) Incorrect operation of pressure vacuum warning device. (h) Damaged inoperative light/laden valves. (i) Defect light indicator.
(ii) Efficiency	Carry out the test with a static brake testing machine or at a road test using either an indicating or recording decelerometer. It is preferable for goods vehicles to be laden for this test. If, however, the vehicle is not laden: (a) For air brakes measure the braking effort up to point of wheel slip and extrapolate to obtain indication of braking effort applicable when vehicle is laden (b) For hydraulic brakes measure the braking effort at pedal pressure up to point of wheel slip	(a) The brake does not give at least the minimum figure laid down in the Regulations.

Items to be inspected	Procedure for inspection	Reasons for Rejection
	and extrapolate to obtain braking effort for laden vehicle. Note: If the emergency brake can be isolated from the service brake the above inspection can be carried out	
(C) Parking brake		
(i) Mechanical Condition	Carry out a visual inspection of the components of the vehicle on a pit or hoist while the brake is eventually operated with a pedal-presser for parking brake components.	(a) Any fractures, deformation or badly corroded parts (b) Any excessive wear in pivots or absence of properly locked connectors. (c) Any obstruction to free movement (d) Insufficient reserve travel of operating pedal. (e) Incorrect operation of pressure vacuum warning device.
(ii) Efficiency	Carry out the test with a static brake-testing machine or at a road test using either an indicating or recording decelerometer. It is preferable for goods vehicles to be laden for this test. If, however, the vehicle is not laden: (a) For air brakes measure the braking effort up to point of wheel slip and extrapolate to obtain indication of braking effort applicable when vehicle is laden (b) For hydraulic brakes measure the braking effort at pedal pressure up to point of wheel slip and extrapolate to obtain braking effort for laden vehicle. Note: Carry out the above inspection with parking brake or operate parking brake whilst vehicle is on a slope of know gradient.	(a) The brake does not give at least the minimum figure laid down in the Regulations.
(D) Brakes on trailers		
(i) Mechanical conditions	Carry out a visual inspection of the components of the vehicle on a pit or hoist while the brake is eventually	(a) Any fractures, deformation or badly corroded parts (b) Any excessive wear in pivots or

Items to be inspected	Procedure for inspection	Reasons for Rejection
	operated with a pedal-presser, paying special attention to the couplings between trailer and drawing vehicle.	absence of properly locked connectors. (c) Any obstruction to free movement (d) Any leaks in or damage to hydraulic / air / vacuum pipes or reservoirs (e) Loose attachment of components. (ii) If the overrun brake mechanism is not operating.
(ii) Automatic operation	Disconnect coupling between the trailer and drawing vehicle.	(a) The brake is not automatically applied when couplings are disconnected.
(iii) Efficiency	Carry out the test with a static brake testing machine or at a road test using either an indicating or recording decelerometer. It is preferable for goods vehicles to be laden for this test. If, however, the vehicle is not laden: (a) For air brakes measure the braking effort up to point of wheel slip and extrapolate to obtain indication of braking effort applicable when vehicle is laden (b) For hydraulic brakes measure the braking effort at pedal pressure up to point of wheel slip and extrapolate to obtain braking effort for laden vehicle. Note: Overrun brake efficiency can be checked by applying the handbrake while on a brake test machine.	(a) The brake does not give at least the minimum figure laid down in the Regulations.
2. Steering		
(A) Steering column & Wheel		
(i) Steering wheel condition	With roadwheels on ground rock steering wheel from side to side at right angles to column and apply slight downward and upward pressure. Visual examination of play.	i) Relative movement between wheel and column indicating looseness. ii) Absence of retaining device on wheel hub.

Items to be inspected	Procedure for inspection	Reasons for Rejection
		iii) Fracture or looseness of hub, rim or spokes.
(ii) Steering column	With the vehicle on a pit or hoist and the weight of the vehicle off the roadwheels in straight ahead position turn wheel clockwise and anti-clockwise as far as possible without feeling resistance due to roadwheel being turned. Observe amount of free movement.	i) Excessive free play in steering. For example movement of point on rim exceeding one fifth diameter of wheel.
(B) Steering gear		
(i) Gear condition	With road wheels off ground rotate steering wheel from lock to lock and examine operation of steering gear visually.	i) Roughness in operation of gear. ii) Sector shaft twisted or splines worn. iii) Excessive wear in sector shaft bushes. iv) Excessive "end float" of sector shaft.
(ii) Gear casing attachment	With the vehicle on a pit or hoist and the weight of the vehicle on the road wheels on ground steering wheel clockwise and anticlockwise and examine visually the attachment of gear casing to chassis.	i) Steering gear casing moving at attachment. ii) Elongated fixing holes in chassis iii) Missing or fractured fixing bolts iv) Steering gear casing fractured.
(C) Steering linkage		
(i) Condition	With roadwheels on ground rock steering wheel clockwise and anti clockwise and examine the steering components for wear, fractures and security.	i) Relative movement between components which should be fixed. ii) Excessive wear at joints iii) Fractures or deformation of any component. iv) Absence of locking devices. v) Misalignment of components (eg. Track rod or drag link). vi) Any repairs by welding, heating or brazing.
(ii) Operation	With road wheels off ground rotate steering wheel from lock to lock and examine movement of linkages.	i) Any moving part of steering linkage fouling fixed part of chassis. ii) Steering stops not operating.
(iii) Power steering	With roadwheels on ground and engine running and the steering wheel being steering mechanism. With	i) Mechanism not working. ii) Any fractures or insecurity of mechanism.

Items to be inspected	Procedure for inspection	Reasons for Rejection
	integral power rocked examine the operation of the steering only examination to determine that mechanism working is possible.	iii) Any fluid leakage. iv) Misalignment and fouling of components.
	3. Chassis and body items	
(A) Principal items on chassis		
(i) Chassis or chassis frame	Carry out a visual examination with vehicle on a pit or hoist	i) Fracture or deformation of any side or cross member. ii) Insecurity of flitch plates or fastenings iii) Excessive corrosion which affects the rigidity of the assembly.
(ii) Fuel tank and piping	Carry out a visual examination with vehicle on a pit or hoist	i) Insecure tank or pipes. ii) Leaking fuel or missing effective filler cap. iii) Damaged or chafed pipes. iv) Any special requirement for liquid gas fuel not met.
(iii) Exhaust pipe & Silencer	Carry out a visual examination with vehicle on a pit or hoist	i) Insecure or leaking exhaust system. ii) Silencer not functioning efficiently. iii) Fumes entering driving compartment.
(B) Suspension items		
(i) Condition of springs	Carry out a visual examination with vehicle on a pit or hoist.	i) Insecure attachment of springs to chassis or axle. ii) A damaged or fractured spring component.
(ii) Condition of shock absorbers	Visual	i) Insecure attachment of sock absorbers to chassis or axle. ii) Damaged shock absorber.
(C) Auxiliary items		
(i) Bumper bars	Visual examination not necessarily on pit or hoist	i) A loose or damaged bumperbar (damage likely to cause injury)
(ii) Engine mountings	Visual examination not necessarily on pit or hoist	i) Deteriorated, loose or fractured mountings
(iii) Trailer coupling	A visual examination of the coupling for wear and correct operation of its component parts with special attention to any safety device fitted. Disconnect trailer from drawing	i) Excessive wear in a component. ii) Insecurity of coupling to chassis. iii) Any safety device not operating correctly. iv) Any indicator not working.

Items to be inspected	Procedure for inspection	Reasons for Rejection
	vehicle if this can be done without use of workshop tools.	
(D) Electrical Equipment		
(i) Electrical wiring	Carry out a visual examination with vehicle on a pit or hoist and also from engine compartment in some cases. For vehicles towing trailers examine the electrical connection between each vehicle. Note: apparatus for checking connections is available.	i) Wiring not adequately cleared or secure. ii) Damaged or deteriorated insulation. iii) Trailer and towing vehicle electrical connection not functioning correctly.
(ii) Battery	Carry out a visual examination with vehicle on a pit or hoist and also from engine compartment in some cases. For vehicles towing trailers examine the electrical connection between each vehicle. Note: apparatus for checking connections is available	i) Battery insecurely fixed. ii) Battery leaking.
(E) Body items (goods vehicles)		
(i) Security of body	Visual with vehicle on pit or hoist	i) Body not located squarely on chassis. ii) Insecure or missing fixing of body to chassis or cross members. iii) Excessive corrosion at fixing points on integral bodies.
(ii) Seatbelts	Visual inspection	I. Presence of seat belts or correct type II. A seat belt not securely fixed to the seat or to the structure of the vehicle
(ii) Condition of body	Visual with vehicle on pit or hoist	i) Defective hinges, doors, retaining devices. ii) Body panels and floor damaged to such an extent that it would be dangerous to carry a load. iii) Insecure body pillars.
(iii) Tipping gear	Visual with the vehicle on pit or hoist. The operation of the tipping gear being optional depending on the time available and whether the vehicle is loaded or not.	i) Tipping gear not working satisfactorily. ii) Hydraulic fluid leaks. iii) Tipping gear controls defective.

Items to be inspected	Procedure for inspection	Reasons for Rejection
4. Road wheels and Axles		
(i) Axles	A visual examination with vehicle on pit or hoist	i) Any fracture or deformation of axle. ii) Insecure fixing of axle to vehicle. iii) Any repairs by welding, heating or brazing.
(ii) Stub axles, suspension joints, and wheel bearings	With vehicle on a pit or hoist rock each wheel whilst raised from ground and: a) note the amount of movement between axle beam and stub axle or at the suspension joints; b) note the amount of movement of the wheel relative to the stub axle to assess play in wheel bearings and rotate wheel. Lift wheel from bottom and note amount of upward movement of stub axle. Note: It is important that the jackig beam point is appropriate to the type of suspension.	i) Excessive wear in swivel pin and/or bushes or at the suspension joints. ii) Excessive play or noise in wheel bearing. iii) Excessive lift between stub axle and axle beam. iv) Stub axle pin loose in axle.
Wheel Balancing	Test on side slip tester	As per specifications of manufacturers
(iii) Road wheels	Visual examination of both sides of each wheel whilst the vehicle over pit or hoist	i) Any fracture or welding defective. ii) Any wheel nut missing or loose. iii) Any wheel stub missing. iv) Tyre retaining rings not properly fitted. v) A badly distorted wheel.
(iv) Road wheel hubs	A visual examination	i) Any half shaft nuts or studs missing or loose. ii) Any nut not properly locked.
(v) Tyres	Visual examination with vehicle on pit or hoist	i) Tyres of insufficient capacity to carry load on each axle. ii) Tyres on same axle or on twin wheels of different sizes. iii) Tyres on same axle of different type (radial or cross ply). iv) Any damage or cut to tyre. v) Insufficient tread on a tyre.

Items to be inspected	Procedure for inspection	Reasons for Rejection
5. Lighting and Signalling Equipment		
(A) Headlamps		
(i) Aim	Use headlamp aiming device to determine the horizontal and vertical aim of each headlamp both as main and passing beam. Preference is given to an apparatus that is fixed on rails.	i) The aim of a headlamp not within the limits laid down by the Regulations. ii) Switching arrangement of headlamps not in accordance with Regulations.
(ii) Switching	Visual	i) The number of headlamps which can be illuminated at the same time not in accordance with the Regulations.
(B) Obligatory front lamps		
(i) Compliance with the Regualtions	Visual	i) Colour, position or intensity not in accordance with the requirements of the Regulations.
(C) Stop Lamps		
(i) Compliance with the Regulations	Visual	i) Colour, position or intensity not in accordance with the requirements of the Regulations.
(D) Number plate lamps		
(i) Compliance with the Regulations	Visual	i) Not in accordance with the Regulations.
(ii) Condition & function	Visual	i) Defective optical equipment. ii) Lamp throwing light to the rear of the vehicle. iii) Defective bulb.
(E) Front, rear & side-reflectors		
(i) Compliance with the Regulations	Visual examination	i) Not in accordance with Regulations.
(F) Direction indicators		
(i) Switching	Visual and by operation	i) Switching of lamps not in accordance with Regulations. ii) Any provision for special switching of direction indicators (eg. All indicators flashing) not operation satisfactorily.
	6. Environment	
I. Noise	Measure sound pressure level with help of a sound level pressure level	As per standards prescribed in the regulations

Items to be inspected	Procedure for inspection	Reasons for Rejection
	meter meant for holding with calibrator in hand and recording the sound level	
II. Exhaust emissions	▪ Idle tests for gasoline vehicles with help of gas analysers ▪ Free acceleration tests for diesel with help of smoke meter	Not confirming to prescribed in use vehicle emission standards as per the regulations

G

Model code of practice for vehicle inspection centres

The objective of this Code of Practice is for the Approved Inspection Centres (AIC) to use when inspecting motor vehicles for the purposes of issuing an inspection certificate. The Code should essentially cover three sections.

- Section1 covering the Conduct of Approved Inspection Centres and their roles and responsibilities etc.
- Section 2 detailing Vehicle Inspection Guidelines and the procedure for inspecting a vehicle. This code could also be in form of manuals prescribing on how tests should be done for different types of vehicles.
- Section 3 has AIC Information Sheets and formats to be filled in by the inspector while inspecting a vehicle for each of the test items as mentioned in the checklist.

This code of practice focuses on the section 1, since more detailed work needs to be done for prescribing the Vehicle inspection guidelines and AIC information and record sheet.

Introduction

This Code of Practice sets out the details for detection of vehicle defects or unsafe vehicle condition by inspection. It is not expected that vehicles will be tested to stringent standards which require extensive or destructive testing or highly specialised equipment that are specified in the type approval documents.

A Safety Certificate or a Certificate of Inspection is a certification that a vehicle meets the safety requirements of the MV Act, 1988. It is expected that the Approved Examiner will utilise their trade qualifications and experience in motor vehicle repairs and maintenance for which the approval was issued and refer to any relevant information regarding vehicle manufacturer's specifications to ensure, as far as practicable, that the vehicle meets the requirements of the motor vehicles.

This code of practice also outlines the duties of the Approved Inspection Centre (AIC) proprietor and nominee, the duties of approved examiners and the qualifications they must have and the equipment that is to be provided and maintained at the AIC. This publication complements the existing skills, knowledge and experience of Approved Examiners and aids in determination of vehicle condition.

AIC requirements

1.1 An AIC is an establishment such as a service station, garage or workshop where motor vehicles are inspected as required under the provisions of section 56 of the Motor Vehicles Act, 1998. The people who supervise and carry out inspections must be authorised to do so in writing by the State Government.

1.2 Depending on the qualifications of the staff and the facilities available, a centre may be authorised to inspect any number of classes of vehicles or a particular class.

1.3 An AIC must have a PROPRIETOR or NOMINEE and at least one APPROVED EXAMINER. One person may hold both of these positions.

1.4 The proprietor of an AIC may be an individual, a registered partnership or a body corporate. The proprietor must be in control of the business, which operates the centre.

1.5 The proprietor may nominate one or more persons to carry out the proprietor's duties in respect of the conduct of the AIC, the inspection of vehicles and the maintenance of the station's premises and equipment. A proprietor's nominee will only be approved after consideration by the department. The proprietor will be held responsible for the nominees' actions.

1.6 The proprietor and nominee of an AIC are responsible for its operation and the conduct of an approved examiner(s).

1.7 The approved examiner is responsible for the actual vehicle inspection and is required to conduct a thorough inspection of each vehicle submitted and certify as to its condition in the INSPECTION REPORT. (Triplicate copy)

Legal status of the code of practice

2.1 Approved Inspection Centre are governed by legislation covered under section 56 of the Motor Vehicle Act, 88.

Non compliance with the code of practice

3.1 Prosecution action may be initiated against a proprietor, nominee or an examiner if an offence against the Motor Vehicles Act is detected. If a court conviction is recorded, the approval issued to the proprietor, nominee or examiner may be suspended or cancelled.

3.2 In other circumstances, if a breach of the Act, Regulation or of a condition of approval is detected, it will be investigated and if found to be substantiated, the Approved Inspection Centre proprietor, nominee or examiner concerned may be asked to show why their approval should not be suspended or cancelled.

3.3 Where the department takes action to suspend or cancel an approval, a person whose interests are affected by the decision may request a review of the decision. If, after a review of the decision, a person is still aggrieved, they may lodge an appeal through a magistrate's court against the revised decision.

Types of stations

4.1 An AIC is one where inspections are available for a range of vehicle types depending on the classes of vehicles for which it is approved. These centres are required to be open to the public to arrange inspections at any time during normal business hours. Mobile AIC units may also be approved as an extension to a fixed premise.

4.2 Inspection Stations may be approved for one or any combination of vehicle types, fuel used provided the proprietor employs appropriately qualified staff and has the necessary equipment.

How a centre is approved

5.1 An applicant must complete an "Application for Approval of Premises as an Approved Inspection Centre" form in detail and forward it together with the appropriate fees to the State Transport Department.

5.2 If the applicant is a company or a business controlled by a company, it is the applicant's responsibility to provide with the application, a company search (current company details) outlining company particulars, including Directors and Business Names Certificate.

5.3 If the applicant trades under a business name only (no company involvement), it is the applicant's responsibility to provide, with the application, a business names extract outlining particulars including persons involved with the business, etc.

5.4 If the applicant is a sole trader, a declaration to that effect must be provided with the application outlining the name by which the inspection station will be known.

5.5 On receipt of the completed application form, prescribed fees and other documentation, an initial assessment will be made of the application. If the application is refused or further information is required, the applicant will be advised in writing. If the application is acceptable, arrangements will be for an Inspector to call and inspect the premises and equipment.

5.6 If the application is successful, a Certificate of Approval for the premises as an AIC as well as other relevant documentation will be forwarded to the applicant.

How to qualify as an AIC proprietor or nominee

6.1 The proprietor of an AIC or any proprietor's nominee must be a fit and proper person and an intending proprietor or nominee's previous history regarding any convictions, complaints or show cause proceedings with the department in relation to the motor vehicle industry may be taken into consideration in the approval process. The proprietor can only nominate a proprietor's nominee.

6.2 The proprietor and/or nominee must have a thorough knowledge of the relevant Acts and Regulations, particularly those dealing with the operation of the centre. Applicants are required to demonstrate their understanding of the AIC requirements before they will be approved. These requirements are prescribed in the Central Motor Vehicle Rules' 89.

Duties of proprietors and nominees

7.1 The proprietor and any proprietor's nominee is responsible for making sure that an AIC is operated strictly in accordance with the Act and Regulation. This Code of Practice provides the detail on how compliance with the requirements of the Act and Regulation may be achieved.

7.2 The proprietor and nominee must make sure that all of the centres inspection equipment, including the equipment of any mobile service, is kept in a good and serviceable order. The inspection area should be kept clean and requests for inspections should be accepted promptly and dealt with as quickly as possible. Also, the approved examiners should have access to such technical data and manuals as are needed to enable the checking of a vehicle manufacturer's specifications as required.

7.3 If the prescribed inspection equipment is not available at the AIC (including a mobile AIC) or becomes unserviceable, inspections for which that equipment is needed, are not to be carried out (and inspection reports and certificates are not to be issued) until the equipment is either repaired or replaced. An approved examiner must be employed and the minimum equipment maintained during the currency of the inspection station approval.

7.4 Produce on request, the Certificate of Approval for the AIC to any person presenting a motor vehicle for inspection.

7.5 Supervise approved examiners employed at the AIC and ensure that these persons properly discharge their duties under the Act.

7.6 Ensure that the provisions of the Act and Regulation relating to safety certificates and certificates of inspection are observed.

7.7 Whenever a vehicle passes an inspection at an AIC, and the correct type of inspection report has been prepared, the proprietor or nominee must sign the Safety Certificate or COI to certify that the inspection was actually carried out by an approved examiner in accordance with Code of practice. The proprietor or nominee must also ensure that the vehicle has been described correctly.

7.8 A proprietor or nominee must make sure that records of the vehicles inspected at the AIC and the examiners employed there are kept, that all books of certificates are kept at the station during normal working hours and are stored in a safe place at all times. Used books of certificates containing the quadruplicate copy of any certificate must be retained for 3 years from the date of issue of the last certificate in the book.

7.9 Furnish to State Transport Department completed forms relating to the vehicles inspected at the approved site as required.

7.10 Advise State Transport Department of the registered number and the owner's name and address of any vehicle, which was found to have a defect that would affect its safe use and was not returned for reinspection within 14 days of the first inspection.

7.11A person must not inspect vehicles or certify to the condition of vehicles unless that person is also an approved examiner.

7.12 A proprietor or nominee must not issue a Safety Certificate or a COI, whichever is applicable, to the owner of any motor vehicle which has been modified from the manufacturer's specifications unless:
(i) such owner produces a written approval certificate from competent government authority in respect of such modifications; or

7.13 A proprietor or nominee must not allow any person to sign certificates or inspection reports or any other documents unless State Transport Department has approved that person for that specific purpose.

7.14 State Transport Department must be notified immediately if any unused inspection certificates, modification certificates or modification plates issued to the person are lost, destroyed or stolen. This advice must be confirmed in writing within 7 days.

7.15 On ceasing to carry on the business of an AIC at the premises specified in the approval, the proprietor must, within 7 days, notify the authorities in writing, and return the certificate of approval, certificate of renewal, unused certificate forms, and used certificate forms up to 12 months old.

7.16 A proprietor or proprietor's nominee must not sign a certificate before it has been completed and signed by an approved examiner.

7.17 Each nominee performing the functions on behalf of the proprietor regarding the operation of the AIC must have a sound knowledge of the relevant provisions of the Motor Vehicle Act and the Vehicle Standards and Safety Regulation.

7.18 The proprietor must obtain the approval of State Transport Department on any proposed changes to the particulars under which the station was approved, the station's personnel or in the conditions of operation of the station. An application for approval of any changes should be made to the approved authority prior to the actual changes being made.

How to qualify as an approved examiner

8.1 An applicant for approval as an examiner must possess a certificate as a "Motor Mechanic", a recognised equivalent Certificate. Where it is intended that the approved examiner will inspect motorcycles only, a certificate as a "Motorcycle Mechanic" or a certificate as a "Motor Mechanic" together with evidence of acceptable experience in motorcycle repairs will be required.

8.2 An applicant is required to have a thorough knowledge of all the classes of vehicles that the examiner is authorised to inspect before approval can be given to operate at a particular AIC. An approved examiner who has not been involved with the AIC scheme for a period of more than twelve months may be required to pass another examination.

8.3 An approved examiner must know the requirements for determining if a vehicle has any defect that would be likely to affect the safe use of the vehicle on a road and that the vehicle complies with requirements of the regulation in relation to vehicle defects. The person must fully understand the requirements of the Act and Regulation.

8.4 Before being authorised as an examiner, an applicant may be asked to demonstrate a thorough knowledge of inspection procedures for the classes of vehicles for which authority is sought and may be required to pass a written examination.

A copy of the applicant's qualifications must be attached to the examiner application form and the original documents produced at the time of examination.

8.5 An approved examiner must have the appropriate driver's licence for the class or classes of vehicles to be inspected at a particular AIC.

8.6 A person nominated as an approved examiner must be a fit and proper person and any previous history regarding convictions, complaints or show cause proceedings with the department in relation to the motor vehicle industry, may be taken into consideration in the approval process.

8.7 An application to become an approved examiner must be in the approved form and must be accompanied by the prescribed fee.

8.8 A person can be nominated as an approved examiner at an AIC by either the proprietor or a nominee of the station.

Duties of an approved examiner

9.1 The approved examiner must conduct a thorough inspection of each vehicle that is submitted for inspection. The inspection must be conducted to determine whether the vehicle meets the Vehicle Standards and Safety Regulation in relation to defective vehicles. This Code of Practice is referred to in the regulation as providing technical guidance about what constitutes a defective vehicle and is admissible as evidence in a proceeding.

9.2 The approved examiner must inspect only the classes of vehicles for which approval has been given. No other class of vehicles may be inspected.

9.3 Upon completion of each inspection **and not before**, the approved examiner must ensure the certificate is completed in section, sign and then pass the certificate to the proprietor or the proprietor's nominee to certify that the inspection has actually been conducted in accordance with the Act and Regulation.

9.4 An approved examiner is permitted to have assistance when necessary; for instance, another person may apply the brake pedal while the examiner checks the operation of brake actuators. Where a vehicle is returned for re-inspection after rectification of faults found by one examiner, it is permissible for the re-inspection to be carried out by another examiner at the same site if the original examiner is absent.

9.5 The approved examiner must maintain a good knowledge of the inspection requirements, procedures and any relevant standards including all AIC Information Sheets and vehicle inspection procedures that are issued from time to time, relevant to the inspection of vehicles.

9.6 The approved examiner should consult and be familiar with a vehicle manufacturer's technical data to assist in determining whether components such as brakes, suspension and steering are serviceable or defective.

9.7 The approved examiner must ensure that all vehicle identification information recorded on the Safety Certificate or COI is taken directly from the vehicle inspected, and is accurate and legible.

9.8 When a licensed examiner is conducting a road test, the use of a section of a public road should involve extreme caution, taking into consideration all traffic requirements and conditions.

9.9 An approved examiner may inspect vehicles only at the AIC for which specific approval is granted or in accordance with the conditions of the mobile AIC. If an examiner is required to inspect vehicles at more than one AIC, the examiner must be separately nominated and approved for each of the stations in question, provided the same proprietor owns them.

Equipment and premises

10.1 Any premises that are used as an AIC should have a clear inspection area with a hard level surface separate from any space that is regularly used for other activities such as fuel sales. The entrance to the AIC and to this area should be at least 2.5 metres wide and where necessary must be high enough for all vehicles of the classes covered by the station's authority (as a general rule, a height of 2.4 metres will be sufficient for motor cars and light commercial vehicles, and 4.5 metres for heavy commercial vehicles).

In all circumstances the requirements of the labour and public health laws must be taken into consideration.

Equipment

10.2 The person, business or company who operates an AIC must have:

- (i) an inspection pit, hoist or ramps or suitable equipment to conduct a thorough inspection underneath vehicles;
- (ii) a decelerometer, brake testing machine or other equipment for testing brakes;
- (iii) a headlamp testing screen or headlamp testing machine;
- (iv) suitable vehicle jacks (as required);
- (v) suitable general purpose tools (as required);

(vi) light testing equipment as necessary (trailers only);

(vii) For a mobile AIC, suitable ramps or other equipment which allows a thorough inspection to be conducted underneath the vehicle is an acceptable alternative to item (1) above. Items (2) to (6) inclusive must be available in the mobile AIC vehicle and used by the examiner at the time of inspection.

Brakes

10.3 When an approved examiner is inspecting a braking system and components such as pads, linings, discs and drums are not visible, the removal of wheels and drums will be necessary to ensure all parts are in a serviceable condition.

10.4 All centres must use a brake decelerometer or brake testing machine for brake testing. Where it is not possible to test brakes using a meter or machine because the vehicle is of a particular type (motorcycle or trailer), the inspection of the braking system must confirm that the vehicle will meet specified stopping distance requirements.

10.5 A decelerometer must be of a type that can be located securely in the vehicle under test, that does not dislodge under braking and that measures braking efficiency in terms of peak deceleration in metres per second per second. A decelerometer may also display the distances to stop in addition to the peak deceleration reading.

10.6 Road testing of brakes should be conducted on a hard level surface that is free from gravel or other loose material.

Headlights

10.7 Headlight aim is to be tested on a graduated screen placed 9 metres in front of the vehicle or by using an approved type headlight-testing machine.

10.8 AIC which inspect trailers must have the following equipment for testing trailer lighting and braking system/s when a towing unit is not available:

- equipment for testing the operation of the lighting system and any electric brakes via the trailer plug or socket;
- a device capable of compressing the tow coupling to test the function of any override braking system;

- a vacuum source capable of testing the function of any vacuum braking system;
- Compressed air sources capable of testing the functions of any full air or air assisted braking system.

Technical information

10.9 Although this Code of Practice provides technical information about inspection requirements, all stations should have ready access to motor vehicle manufacturer's specifications and technical information about the classes of vehicles that they are authorised to inspect. This is particularly important in the case of brakes, steering and suspensions because information about allowable wear in these systems can usually be checked by referring to vehicle manufacturer's specifications. Generally, it will be satisfactory if the station has the technical reference manuals that are readily available. Vehicle specification charts bulletins and some tune-up manuals are also a good source of technical information.

Signs and advertising

11.1 You may display a sign on the premises indicating the site is authorised by State Government Transport to issue Safety Certificates or COI's. The sign should contain at least the following information:

Approved inspection centres approval no.

The first three words should be in letters 100 mm high and the remainder in letters 50-mm high, wording should be black on a contrasting background.
A mobile unit **must** clearly display the AIC trading name and AIC approval number. This information must be clearly visible for a distance of 30 metres on both sides of the mobile unit.

Procedure for granting a road worthiness certificate

The following steps could be adopted for granting a roadworthiness certificate to in-use vehicles. The detailed procedure to be followed by the inspection centres would be detailed out and discussed in the manuals developed separately for different types of vehicles.
Step 1: An inspection notice to be issued by the Government within 2 months of the expiry of the certificate.
Step 2: Vehicle owner to fix an appointment with the government authorised vehicle-testing station

Step 3: The vehicle testing station to test the vehicle as per the guidelines in the "manual"

Step 4: If vehicle is found fit; the vehicle inspection centres would

a) Issue a test report

Step 5: If a vehicle is found unfit; the vehicle inspection centres would

a) Issue a rejection notice with the test report
b) The vehicle must report to an authorised vehicle repair centre and get repairs done
c) The vehicle must return within 15 days of the rejection notice to the inspection centre for re inspection
d) Second test is conducted on the items which failed on the first test
e) If the vehicle passes the test, step 4 is repeated

Step 6: The owner would get a vehicle fitness certificate from a centralised vehicle certification centre. They would:

a) Issue a road worthiness certificate completed and signed
b) The certificate is valid for the time period depending on type and age of the vehicle

Inspection fees

13.1 An AIC must not charge more than the fee prescribed by the govt. under CMVR for vehicle examinations that are conducted for the issue of a Safety Certificate or a COI.

13.2 Different fees are prescribed for each of the following classes of vehicles:

1. Car or light commercial vehicle;
2. Heavy commercial vehicle;
3. Motorcycles;

13.3 An approved examiner may require the removal of one (1) or more wheels and brake drums or rotors if the examiner has reasonable grounds to believe that a defect exists.

The proprietor must notify the owner of this requirement and negotiate appropriate labour costs and charges for non re-useable parts such as lock nuts lock tabs, split pins, lubricants, etc **BEFORE** proceeding. These additional charges **ARE NOT** part of the examination fee.

A mobile AIC may charge reasonable travelling rates in addition to the fee for inspection. Vehicle owners are to be advised of these charges during initial negotiations.

13.5 Remember, the integrity of the AIC scheme will depend on customer communication, together with fair and reasonable charges, should any extra charges be required.

How to carry out an inspection

Registered vehicles

14.1 When conducting an inspection of a motor vehicle, the approved examiner should carry out no less than the following checks:

1. Check the registration plate, engine number and/or the chassis/VIN number on the vehicle against the details on the registration certificate (if available); record the make and model and the odometer reading.
2. Examine the vehicle's exterior.
3. Check all doors, windows and bodywork.
4. Sit in the driver's seat and test all the driving controls.
5. Check seats, seat belts, mirrors, and sunvisors, glazing and forward vision through the windscreen.
6. Check the operation of steering linkages and all lights, including the aim of the headlights. (Another person may be required to assist with the inspection of steering and some lights.)
7. Open the bonnet and check the engine, battery and any other items listed in the inspection guide.
8. Check the operation of all steering linkages, all road wheels and their fastenings, check the tyres.
9. Jack the vehicle up and check the suspension, wheel bearings and steering components.
10. Check the underbody, chassis, subframes, engine and drive train, suspension systems, exhaust and braking system components. If it is necessary to remove wheels and drums to effectively examine braking components, this task should be carried out.
11. Test the service brake and parking/hand brake. Record the results.
12. Make sure the odometer and speedometer are operating and check the vehicle for poor handling, pulling to either side or undue vibrations.
13. Prepare the inspection report carefully, making sure that all necessary information is given.

NOTE: It is acceptable if the proprietor gives the owner a detailed list of the repairs together with the required Inspection Report.

All vehicles

14.2 Inspections should be carried out in a logical manner. The inspection reports show the various vehicle systems that are to be checked. Proprietors/nominees and approved examiners should remember that the vehicle owners rely on them to ensure their vehicles meet legal requirements and are safe to drive on the road.

How to complete a safety certificate and a certificate of inspection

15.1 When completing the first and second inspections for the issue of a Safety Certificate or a COI, the following process is to be followed:

1. The owner's name and address and vehicle details are to be entered on to the certificate prior to the beginning of the examination.
2. If no defects are found during the first inspection, the relevant sections of the Safety Certificate or the COI are then completed. The examiner must ensure the certificate is completed legibly and accurately and sign the inspection result and the certification. Before issuing a safety certificate, an approved examiner must indicate the date of issue of the safety certificate by punching a hole through the appropriate day, month and year on the label part of the certificate.
3. The proprietor or nominee shall then sign and issue the front label, the original, duplicate and triplicate copies of the certificate to the person presenting the vehicle for inspection.
4. If a defect is found during the first inspection, the examiner shall sign the first inspection section and give the inspection report (triplicate copy) to the person presenting the vehicle, outlining what repairs or alterations are required to ensure the vehicle meets inspection requirements. The examiner and proprietor/nominee do not sign the certification section until the vehicle is re-presented and passed within 14 days.
5. If the vehicle and the triplicate copy of the Inspection Report are returned to the Approved Inspection Station within 14 days, the examiner can complete a re-inspection of all items rejected and enter the results of that inspection on the report.
6. If all defects that were required to be rectified have been completed, the examiner is to sign the certification section and the proprietor shall issue the certificate as outlined in (2. and 3.) above.

7. If the defects indicated on the inspection report have not been completed satisfactorily, the examiner will return the Inspection Report to the owner indicating the result of the second inspection and advise that the vehicle still does not meet the inspection requirements for the issue of a Safety Certificate or a COI and the safety certificate is to be cancelled immediately.
8. A complete examination must be conducted if the vehicle is presented for re-inspection after 14 days and a full inspection fee will also be applicable.

15.2 Under no circumstances is an approved examiner to sign the certification on a safety certificate or a certificate of inspection knowing that there are defects that would affect a vehicles safe use on the road or the vehicle does not comply with the requirements for the issue of the safety certificate or the certificate of inspection. Any error or incorrect entry on a certificate must not be corrected or altered and the certificate is to have the word 'cancelled' written across the face of the certificate.

Regular training for approved examiners

Regular training programmes must be organised by the Government for training and upgradation of skills of the trained examiners.

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